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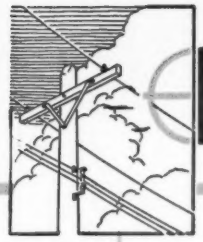

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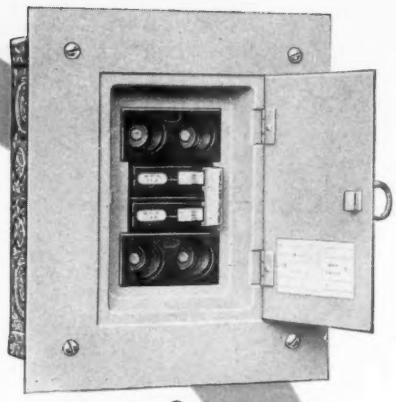

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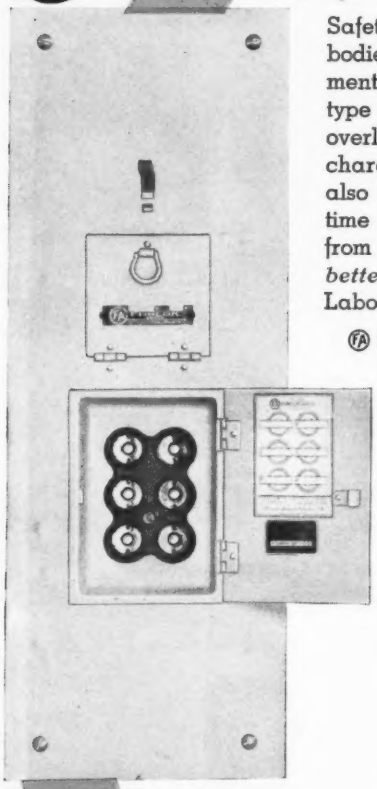

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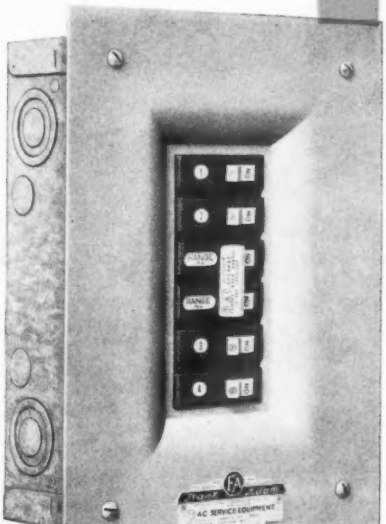

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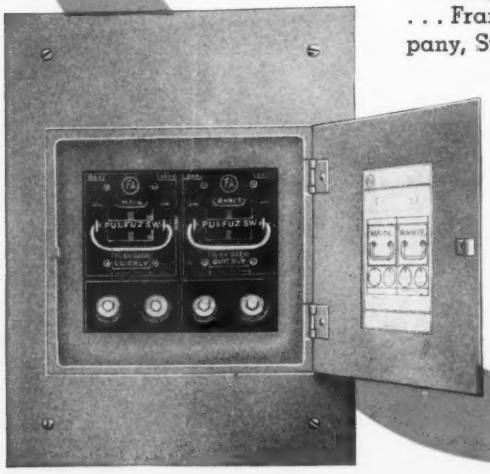

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Network Circuits for Industrials

Flexibility, reliability, and reasonable cost are some of the advantages claimed for the a-c secondary network for light and power distribution in industrial plants.

By C. B. Stainback*

RECENT experience indicates that the a-c secondary network system, which has been applied so successfully to the congested and heavily-loaded business areas in many cities, may now be applied advantageously to the electrical distribution systems of industrial plants.

The design of distribution systems for industrial plants, of course, will always constitute individualized problems. There is little hope that any particular form of distribution will be applicable to all industrial plants because the processes of manufacture and the arrangement of buildings differ widely depending on circumstances. There are, however, certain fundamental advantages to the network system of distribution which justify a much wider use than it has found to date. By far the greater part of factory distribution is still of the radial type and the network system must compete with the radial system in economy, reliability and flexibility. This it can do successfully.

The advantages of the network type of distribution are best presented through comparisons with the other types of distribution. The prime requisites for an electrical system in an industrial plant are as follows:

Flexibility—It must be easily changed to accommodate a re-arrangement of machines within the plant, or extended for a new plant addition, or added loads.

Reliability—It must provide continuity of service in spite of faults that may occur, or at least be restorable with a minimum of delay.

Sabotage Proof—It must be difficult to put out of operation by anyone bent upon impairing the production of the plant.

Voltage Regulation—It should be so designed that the voltage drop at any part of the system should vary as little as possible from no load to full load.

Reasonable Cost—It must have these advantages and still be obtainable at a cost which is not far different from some other system.

Radial Distribution System

The oldest most generally used system is the radial system of which there are many variations. In this system the power is brought in through a main transformer bank to a main switchboard and then to conventional power and lighting panelboards through radial feeders from the main switchboard.

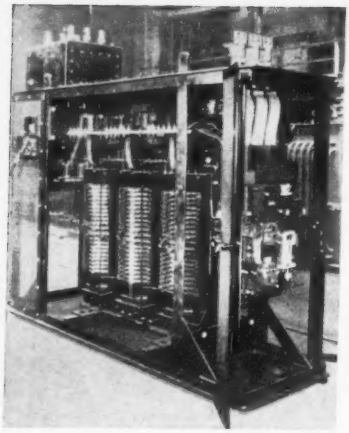
This system analyzed from the standpoint of the five main requisites just mentioned, has the following characteristics:

Flexibility—To a minor degree,

*Mr. Stainback is manager of industrial sales for Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa. This article was adapted from a talk made before the 42nd Annual Convention of the New York Association of Electrical Contractors and Dealers.

Comparison of Inherent Characteristics of Three Principal Types of Distribution

Distribution System	Flexibility	Reliability	Sabotage Proof	Voltage Regulation	Cost	Remarks
Radial	**Limited**—Added feeders ultimately require major revamping.	**Poor** — Single fault at transformer bank or main switchboard interrupts entire power supply.	**Vulnerable** — Destroying main transformers or switchboard shuts down entire plant.	**Poor** — Due to long feeders; regulation may be 15% at the load centers.	**Low**—In simplest form. Excessive cost if flexibility and reliability incorporated.	**Oldest**— Simplest.
Expanded Radial	**Limited**—Major plant expansion requires complete revamping distribution system.	**Fair** — Due to spare capacity built into the system.	**Fair**—Because duplicate feeders supply major loads.	**Fair** — Spare capacity aids regulation; but is not uniformly good throughout system.	**High** — About double cost of ordinary radial system.	**Duplicate** — Equipment used at vulnerable locations.
Secondary Network	**100%** — Adding network units cares for load increases. Secondary loop extended indefinitely for plant expansion.	**Best**—A fault on secondary loop or on primary feeder or network transformer will not cause loss of any load.	**Safest** — Would require simultaneous damage at several points to do much harm.	**Best** — Transformers are located near loads, on overloads all transformers on loop help.	**Low** — Averages 15% more than simple radial and 10-15% less than ordinary elaborate radial system ordinarily used.	**Consider**—For plants with 1200 kva or more load and 10-15 volt amperes per sq. ft. of floor space.



This view of a typical three-phase air-cooled network unit shows the two-way primary switch at the extreme left, the transformer in the center, and the network protector in the right end.

it is flexible by adding breakers to the main switchboard, new feeders, and new panelboards. However, one cannot go far in this direction before being faced with the problem of completely revamping the system from the main transformer bank to the power and lighting panelboards.

Reliability—The system cannot be rated highly on this point since there are several locations where, if faults occurred, the entire system would be shut down for extensive and lengthy repairs. For instance, such faults might occur in the main transformer bank or in the main switchboard.

Sabotage-proof—The same conditions are true on this point. It would not be difficult for a saboteur to destroy the switchboard or main transformer bank and shut down the entire plant.

Voltage Regulation—Because of the long feeders carrying power from the main switchboard to the various load centers, the voltage drop varies over a wide range depending upon the percentage of load at any given time. In the average radial system this might be as much as 15% or more.

Reasonable Cost—In its simplest form it is unquestionably the lowest cost system available. However, if it is designed so as to provide the flexibility, reliability, and sabotage-proof features required in modern industrial plants, its cost becomes excessive.

Next consider an expanded form of the radial system, one in which flexibility, reliability, and sabotage-proof features have been incorporated to some extent. For comparative purposes, we have kept the same basic system, but have shown duplicate equipment at the vulnerable locations. Examining this system on the basis of the same five points, we find that it measures up as follows:

Expanding the Radial System

Flexibility—Except that we have added spare breakers on the switchboard and excess transformer and feeder capacity, we have gained little, since a major plant extension or load increase would again mean a complete revamping of the entire system.

Reliability — From a reliability point of view, we have gained materially, as a result of the spare capacity built into the system.

Sabotage-Proof—Here we have made a definite gain because of the duplicate feeds provided to major load points.

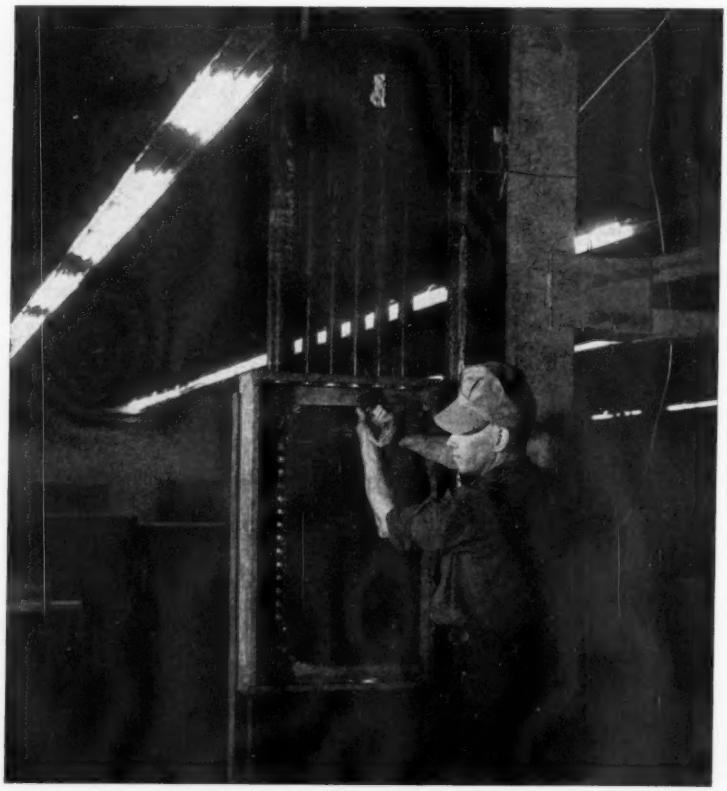
Voltage Regulation — The voltage regulation has been improved because of the large amount of spare capacity built into the system to obtain reliability. However, it is not uniformly good throughout the system.

Reasonable Cost—Since the cost has more than doubled, we have very decidedly lost ground from an overall cost standpoint.

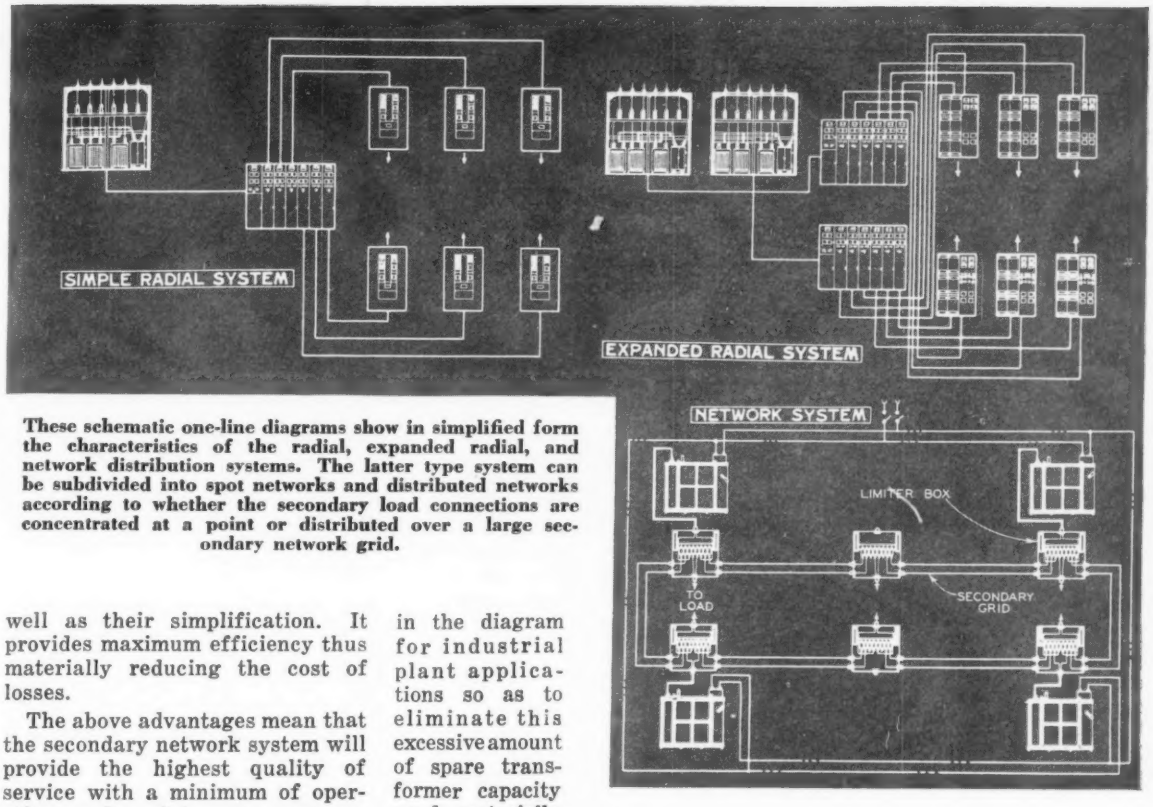
Now let's take a look at an entirely different system which has been in use for many years but only recently adapted to industrial plants: an industrial network system. (See diagrams comparing different type systems.)

Secondary Network is Best

The a-c secondary network is the ideal type of distribution system in continuity of service. In addition to service reliability, the secondary network system possesses a number of other important advantages. It provides uniform and minimum voltage regulation which permits across-the-line starting of relatively large motors at any point on the system. This often results in an appreciable saving in the cost of motor controls as



Typical lighting panelboard in an industrial network distribution system, showing conduit from the network system through breakers to the fluorescent lighting circuits. The tap from the secondary loop or grid is carried in the large conduit at left. Branch circuits are enclosed in the five smaller conduits.



These schematic one-line diagrams show in simplified form the characteristics of the radial, expanded radial, and network distribution systems. The latter type system can be subdivided into spot networks and distributed networks according to whether the secondary load connections are concentrated at a point or distributed over a large secondary network grid.

well as their simplification. It provides maximum efficiency thus materially reducing the cost of losses.

The above advantages mean that the secondary network system will provide the highest quality of service with a minimum of operating and maintenance expense. In order to make the initial investment in a network system compare favorably with that of competing systems, it is necessary to make certain modifications in the usual form of a-c secondary networks that are now widely used for general distribution in the business districts of cities when applying it to industrial plants.

The secondary network system, when used for general distribution, is designed so that peak load can be carried with at least one primary feeder out of service without overloading any part of the system. Since it is unnecessary and impractical to have more than two primary feeders for supplying many industrial plants, one hundred per cent spare transformer capacity would be required if the usual form of secondary network were used. The investment in such a system would usually be out of proportion to the advantages derived from the system, and would be much greater than the investment in the distribution systems usually used in industrial plants.

Spare Transformers Reduced

The a-c secondary network system has been modified as shown in the diagram for industrial plant applications so as to eliminate this excessive amount of spare transformer capacity and materially reduce its cost. This has been accomplished by using a double-throw primary switch with each network transformer and arranging the primary feeders so that any transformer can be connected to either of the two feeders.

Normally half of the network transformer capacity is connected to each feeder. When a fault occurs on one of the primary feeders the faulty feeder is automatically disconnected from the system without any interruption to service by the tripping of the circuit breaker at its supply end, and the tripping of all network protectors in the secondary leads of its associated network transformers. This leaves the entire system load being supplied over one primary feeder and through half the network transformers.

Under this temporary condition of operation, the voltage regulation will be about doubled, and the transformers remaining in service will be loaded to nearly 200 per cent until the transformers associated with the faulty feeder are manually switched to the good feeder. It is recognized that these transformers must and will safely carry this overload for a considerable period of time.

One notable example of a typical network system is operating in one of New York's largest buildings, the Chrysler Building, installed about 1931. So this is not a new scheme; it is only a new application of an old and very successful system.

Principle in Use for 19 Years

When we consider that the a-c secondary network system has been in use about 19 years for general distribution, the question naturally arises as to why it has not been more extensively used in industrial plants. There are a number of reasons why its more extensive use in industrial plants has been delayed.

The development of and operating experience with limiters was essential before 460 volt networks were practical.

The development of safer transformers, such as the non-inflammable liquid filler transformer and especially the non-inflammable, non-explosive air insulated transformer, has made it possible to locate the network transformers in the plants adjacent to the loads to be served without having to go to the expense of building fire-proof explosion-resisting vaults.

Certain modifications in the form of the system also had to be developed before it became economically attractive. The most important of these is the use of the double-throw primary switch to reduce the necessary spare transformer capacity to a minimum.

You will notice that this system doesn't have a main transformer bank nor a main switchboard but instead employs a number of small network transformers with a high voltage connection taken to the primary side of each transformer.

Meets All 5 Requirements

Let us now examine this system on the basis of our same five points.

Flexibility—In a network system load increases can be taken care of by merely adding additional network units connected into the same secondary loop. For plant expansion the loop may be extended indefinitely without changes to the existing equipment.

Reliability—A fault on any cable in the secondary loop will not interrupt service. A fault in one of the primary feeders or network transformers will not cause the loss of any load. The faulty feeder will be automatcally disconnected from the system. Temporarily the transformers remaining in service will be overloaded until the transformers out of service can be connected to the good feeder by manually throwing over their primary switches.

Sabotage-Proof—In order to put this system out of commission, it would be necessary to wreck it at several points at the same time. As a matter of fact, almost any part of the system left intact would continue to function.

Voltage Regulation—In the network system the voltage drop is materially decreased and the voltage maintained more constant because the transformers are located near the loads; and the other transformers in the loop help feed any severe overload such as the starting of large motors.

Reasonable Cost — The cost of the industrial network system will average about 15 per cent more than the cost of the simplest form of the radial system and from 10 per cent to 15 per cent less than the more elaborate forms of radial systems generally used. However, if an attempt is made to match the desirable features of a network, the cost of the radial system would be about double that of a network.

Easy to Install

An industrial network unit consists of an air-cooled network transformer with a double throw primary air switch and a network protector which is nothing more than a motor-operated air circuit breaker with relays so that it will automatically open on reverse current and close when power is available from its associated transformer. All of the network units in a system are duplicates and of relatively small size, so that your installation job becomes one of installing a number of small duplicate pieces of apparatus with only main incoming and outgoing leads instead of the usual switchgear, transformers and substations. Incidentally, the network unit is entirely air-cooled and is non-inflammable so it can be installed in the plant without vaults or venting.

The only other piece of apparatus required in the industrial network is the bus or limiter box.

The cardinal principle of the network system is that secondary faults are burnt clear by the fault current. Experience has shown that while this is entirely feasible with the low voltages and heavy amperages used in metropolitan distribution, it must be modified for application to factory distribution. At 440 volts, secondary faults are not self clearing and it becomes necessary to use protective fuses or limiters at each end of each secondary conductor to definitely clear faults and limit the damage to that section of cable. The limiter boxes are connected in the secondary loop. They provide a means of feeding power into the loop, connecting loads to the loop, and act as terminal points for the different cable runs of the loop itself.

Standard load distribution equipment, such as panelboards, bus ducts, etc., can be used with industrial networks the same as in the conventional radial system.

The network units and bus boxes are all of standard design and can be manufactured as production items, thus eliminating a large part of the engineering time consumed in designing other types of equipment which must be engineered to the job.

To the electrical contractor, the secondary network system offers a new and radically different type of service for industrial customers. This new and improved service has been made possible by years of research in an attempt to adapt to industrial plants the systems which have been proved efficient for central station metropolitan areas and for larger buildings. The adaptation has not been possible until recently owing to the fact that it was necessary to develop the correct type of limiters and safer transformers that do not require expensive vaults.

In these days of tremendous building activity in all industrial fields, the responsibility for installing systems which will give the industrial customer better regulation, better protection against damage by saboteurs, and greater all around satisfaction, belongs to the contractor as well as the consulting engineer. The fact that the secondary network system has been installed by some of the largest industrial organizations in the country is ample proof that both from the standpoint of experiment and experience the network system is the modern distribution system for industrial plants. Within a very short time it will be the standard.

Contractor Benefits 4 Ways

It is natural that you should ask the question, "How will the contractor personaly benefit by selling an industrial network system, instead of a radial system." This is a fair question. In my opinion he will benefit in these four ways:

1. **Satisfied Customers**—He will benefit through satisfied customers by selling them a 1941 system instead of a 1929 system.

2. **Greater Dependability** — In these days when production losses due to shut-downs are so damaging to the success of the national defense program, it is important that you give your customer an installation that offers maximum protection against saboteurs. It is practically impossible for a saboteur to put a network system out of commission.

3. **Ease of Installation** — Your problem becomes one of installing a number of relatively small standard duplicate units instead of made-to-order substations, switchgear, and switchboards.

4. **Greater Net Profit**—It will increase your net profits in the job because of shorter shipments, and more stabilized market and

(*Continued on page* 46)

Wire Simplification Program Will Aid National Defense

By Howard H. Weber*

DURING the past few months one of the chief topics of discussion in the electrical world has been the National Electrical Code and the many complications that have developed as a result of changes that have been made. During the summer and fall, a great many conventions and meetings have been held in which many points in this connection have been raised. The purpose of this article is to review the current situation in the building wire field and to bring the discussion up to date.

Looking backward on the history of the National Electrical Code, the very basis for its significance has been its recognition as a minimum safety standard. It is true that the Code should be and has been changed as invention has made progress, but the National Electrical Code must always observe and provide for a minimum safety standard.

In recent years, we know that in the wire industry progress has occurred in the improved aging of rubber, the tubing of rubber insulation with continuous vulcanization, and the dipping into latex with continuous vulcanization. Improvements in processing have been reflected in better insulated rubber covered wires and cables.

Code Proves Complex

Partly as a result of these improvements, the present Code has proved very complex because of the large number of types of wire, the confusion of designations, and because of attempts to justify the inclusion of these various products by means of highly scientific data not easily understood by laymen.

Various proposals have been made for the elimination of this confusion. The first of these was proposed in an interim revision amendment No. 38 which was circulated to the Electrical Committee. The only action taken on this was to refer the interim amendment to the new Article 310 Committee for further study so that a full report could be made to the 1942 meeting of the Committee. This is all according to regular procedure; that the subject involved was complex goes without saying. Certainly, careful study is required before hasty changes are made in the National Electrical Code. On the other hand there are definite reasons why certain industry problems should be settled immediately.

Attempts at Solution

Attempts to solve some of these problems have been made in Interim Revision Proposal No. 38. Other attempts to find some solution have been typified by the recent action regarding copper wire sizes.

A general conference of representatives of manufacturers, distributors and users, was held in Washington, on April 23rd, 1941. This meeting considered a proposed simplified practice recommendation covering copper conductors for building purposes and drafted a simplified list of stock sizes. The industry has accepted and approved for promulgation as of July 1, 1941, by the U. S. Department of Commerce through the National Bureau of Standards this list of sizes which is as follows:

Simplified Wire Stock Sizes

14 AWG	00 AWG
12 "	000 "
10 "	0000 "
8 "	
6 "	250,000 cir mils
4 "	300,000 " "
2 "	350,000 " "
1 "	400,000 " "
0 "	500,000 " "

It should be noted that sizes larger than 500,000 cir mils up to and including 2,000,000 cir mils are not to be carried in stocks, but are to be made available only on order. This recommendation is not to be construed to mean that every distributor and purchaser should stock all sizes listed. Copies of the booklet designated "R180-41, Cable and Wire; Rubber-Insulated, Building-Type, Conductor-Sizes" may be obtained from the U. S. Government Printing Office in Washington, at a price of five cents.

Stiff Pace Set

Truly, the national defense program has set a stiff pace for the industry to follow. This program has disrupted our supply of raw materials. Among other things which we must conserve and save are rubber, cotton, zinc, tin, and copper. Most of these materials are used in ordinary building wire in one form or another. Any reduction in the consumption of these vital commodities becomes a patriotic duty of our industry. Even a saving in the duplication of wire stock items is a definite step in this program. Therefore, we find agencies like the USHA, the OPM, the Army, and the Navy looking for a way to get things done and still cooperate in the conservation of these necessary commodities. Formerly, the electrical industry solved its own problems; today, as this situation unfolds, we find governmental agencies taking a more important interest.

Raw materials are needed for emergency purposes and are being diverted from normal uses. Not only do we find restrictions applying to various ingredients on the critical list, but we are actually confronted with the allocation of

*Mr. Weber is associated with the United States Rubber Company, New York City. He is a member of NFPA's Electrical Committee and a member of the NEMA Codes and Standards Committee. He is the manufacturers' representative on a standing committee to study simplification of wire and cable sizes and types. This committee was appointed as a result of an industry conference held at the Bureau of Standards earlier this year.

certain materials. As indicated above, routine procedure formerly took care of necessary changes and, eventually, modifications were made in the National Electrical Code, and it kept the industry well informed as new developments came along. Today, other steps are being taken to expedite and simplify our rules and practices.

Let us not forget, however, that the National Electrical Code is recognized and still is national in scope. Its use has brought about standardization in the industry with uniform wire installation and standardized materials and equipment. That this has been advantageous there is no question; but what are conditions today?

New Rules Established

So far as building wire is concerned, new rules were set up in the 1940 edition of the Code, which embodied new loading conditions, new tables—in fact a series of tables. Scientifically, these tables are correct. However, it is certain that for practical purposes they are proving too complicated. It is stated that in many cities where the new Code has been automatically adopted, complaint about the confusion is apparent.

One important trouble reported is the fact that due to national defense needs many of the wires provided for in the Code are not now readily available. Contractors are being penalized by being forced to use large circular mil wire of Type R where smaller sizes of Type RH would do the work. The result is that the National Electrical Code is losing cast and standing. It has been stated that if the RH conductors alone were available, a saving in copper would result which would be in line with defense conservation measures.

Whatever wire tables are recommended by the 310 Committee will undoubtedly be a simplification of the present tables. Until 1940, the current loading table was understandable, and there was no complaint. The tables could be made so now. A prompt study of the situation should be made at once with speedy action taken so as to end the confusion. Fortunately, the National Electrical Manufacturers Association is at work on this right now. It is hoped that their report will be made available promptly.

Summarizing the situation, for more than 50 years the industry lived with basic values set up for Code wire. Current carrying capacities can be returned to the base line of these years of satisfactory field experience. Laboratory tests can be recalibrated using the 1937 Code values as the starting point. Heat resistant or improved aging properties of rubber compound can be reflected by increasing the number of small diameter wires in conduit instead of increased current carrying capacities of individual conductors. Increased heat resistance through improvements in aging properties should be reflected in longer installed life instead of higher operating temperatures.

There is another question involved, and this brought about the action referred to above under the preferred plan of wire sizes which helps to conserve rubber through reducing the number of copper wire sizes carried in stocks and limiting the type sizes to 500,000 cir mils.

At the meeting of the Electrical Committee it was decided to arrange for the paralleling of certain conductors. This is being taken care of through the interim amendment which is now out for action to the members of the Electrical Committee.

Now, as a means of offering a temporary solution of the situation during the emergency, Mr. George Andrae, chairman of the Codes and Standards Committee, of the National Electrical Contractors' Association, has suggested the following for immediate adoption by the industry, which will result in only ten wire items to be carried in stock. These are as follows:

Wire Sizes	Ampere Rating
14 AWG	15 Type R
12 "	20 " "
8 "	35 " "
4 "	60 " "
2 "	80 " "
1 "	100 " "
0 "	150 Type RH
0000 "	200 " "
350,000 cir mils	300 " "
500,000 " "	400 " "

It should be noted that the adoption by the industry of these suggestions involves no change in the National Electrical Code and therefore the effect would be immediate. In commenting on the above, Mr. Andrae says:

"I think it should be our aim to select wire sizes which correspond to the ratings of standard switches such as 30, 60, 100, 200, 400, and 600 amperes. I have attempted to do this in the table of 'Suggested Sizes and Ratings,' using certain Type R sizes from No. 14 to No. 1 and certain Type RH sizes from 1/0 up to 500,000 cir mils.

"1. Take the case of a 30-ampere switch: use three No. 8 Type R wires rated at 35 amperes, allowing something for voltage drop or full load operation. This will prevent overfusing of No. 10 wire from 25 to 30 amperes. From No. 14 to No. 1 there are several sizes whose rating is very close to the next size under and over them and which therefore could be eliminated. From 1/0 up to 400,000 cir mils there is a difference of only 25 amperes between each size, so that several sizes here again can be eliminated.

"2. Take the case of a 60-ampere switch: use No. 4 Type R rated at 60 amperes, corresponding to switch and fuse rating. Formerly No. 6, rated at 50 amperes, was frequently used which meant a 10-ampere loss in switch capacity or the overfusing of the wires. Three No. 4 wires will take the same 1¼-inch conduit as three No. 6 and are the largest permitted in this size conduit.

"3. Take the case of a 100-ampere switch: I suggest restoring 100-ampere value to No. 1 Type R wire and using 1½-inch conduit at much lower cost than 1/0 wire in 2-inch conduit. Number 1 wire is the largest allowed in 1½-inch conduit and the rating corresponds to that of the switch and fuse."

To Reflect Invention

At the outset of this discussion, we said that invention should be reflected in the National Electrical Code. When the proper body meets, this should be done through three steps: (1) Keep the present Type R wire until lack of use renders it extinct. (2) Make provision for a new light wall Type R wire to meet the same requirements as the present Type R in the branch circuit sizes, this to gradually replace the present Type R because economically it will be less expensive to produce. (3) Permit lighter wall of Type RU wire in all branch circuit sizes for all purpose wiring. This undoubtedly will gradually replace both the old and the new Type R because the Type RU will prove less expensive due to the advancement in the art of wire manufacturing.

If the first step is taken, present

(*Continued on page* 46)

Defend Your Business Security With Better Management

1. The Budget—Keystone of Effective Management

By Arthur Roberts

This is the first of a series of articles which will discuss various phases of business management from the viewpoint of the electrical contractor and appliance dealer. A general article, by the same author, discussing the need for better business management in the electrical trade appeared in the November 1941 issue of this publication.

THIS is a time that is trying business men's souls, a time when every element of administrative and mechanical operation must be under systematic control. Our research in the electrical contracting field shows that one control badly needed today is the budget. Only about 10 per cent of the electrical contractors use this important operating device.

In reviewing our records covering the past 5 years of field work, we find that 90 per cent of the contractors using budgets made or exceeded anticipated net profits, only 10 per cent dropped below anticipated net profits by an average of 8 per cent, none lost money. Of those contractors not using budgets, approximately 35 per cent made or exceeded anticipated net profits, 40 per cent did not make the net profits they anticipated, the deficiency averaging 24 per cent, and 25 per cent lost money, even though their estimates worked out profitably on paper.

It is only reasonable to conclude from these findings that budgetary control is essential to the attainment of maximum profits at any time, and today particularly it is a chore that must be spliced into the operating routine if the contractor expects to emerge from this emergency with a reasonable profit instead of tax bills.

Budgetary control is of particular significance to the electrical contractor because it provides a means to make a profit even though local competition is keen. Many a contractor has circumvented competitive price cutting with budgetary control. Decrying keen competition never got the contractor an additional slug in the cash register, but budgetary control, which keeps costs in safe ratio to selling prices, will enable the contractor to control outgo effectively, eliminate loss hazards and make a profit, not always a big profit, but a profit, nevertheless, which, without a budget, would have likely been a loss.

The budget is a pre-determined compilation of estimated figures covering operations for a forthcoming period of any length, preferably, a 3 to 6-month period today. In normal times, a budget is prepared for a 12-month period but because of the fast-changing tempo of the times, the shorter periods are recommended. Every contractor, large or small, can budget to advantage. Build your estimates on your past experience figures and your judgement as to future movement. Here is a practical procedure adaptable to any size contractor.

James Billings did $112,000 in sales in 1941 but at the end of the year his net worth had decreased. Why? Lack of a planned routine. Trying to build a profit without a plan is as difficult as building a house without blue prints. Let's budget Billings' 1942 operations to show how he can work out a plan that offers a chance of profit.

First, consider overhead ex-

Typical Budget for Electrical Contracting Business

MONTH	SALES				EXPENSES*		MARGIN*		COST OF SALES*		NET PROFIT*		
	Past 3 Yrs. Average,	% of Average	Estimated Monthly	Actual Monthly	Estimated Monthly	Actual Monthly	Estimated Monthly	Actual Monthly	Estimated Monthly	Actual Monthly	Estimated Monthly	Actual Monthly	% Actual
January	$ 4,000	3.6	$ 4,300		$ 2,200								
February	3,600	3.2	3,840		2,200								
March	5,600	5.0	6,000		2,600								
April	6,800	6.1	7,320		2,800								
May	10,400	9.3	11,200		3,000								
June	12,000	10.7	12,830		3,200								
July	11,200	10.0	12,000		3,400								
August	12,800	11.4	13,680		3,400								
September	13,000	11.6	13,900		3,200								
October	14,400	12.8	15,360		4,000								
November	10,600	9.5	11,400		3,200								
December	7,600	6.8	8,150		2,800								
	$112,000	100.0	$120,000		$36,000		$42,000		$78,000		$6,000		

$ 1,505 fill in each month's quota by taking 35% of each month's estimated sales

$ 2,795 fill in each month's quota by taking 65% of each month's estimated sales

$ 215 fill in each month's quota by taking 5% of each month's estimated sales

*For the purpose of preparing this specimen budget, the following percentages have been used: Estimated Expense, 30% of Total Estimated Sales; Estimated Gross Margin, 35% of Total Estimated Sales; Estimated Cost of Sales, 65% of Total Estimated Sales; and Estimated Net Profit, 5% of Total Estimated Sales.

This shows how an annual budget is prepared. Whether the period is shorter or longer, the routine is the same. If you prepare a budget for a 3 to 6 month period, use the same form, only fill in 3 to 6 months at a time. Fill in all estimated figures. To simplify reading, we have entered only the first month's quota on margin, cost of sales, net profit. The "%" column at the end of the chart is for recording the actual percentage of net profit earned, figured on sales. Monthly this should be checked against the estimated 5% figure. Keep these forms in a loose leaf binder for aid in the preparation of future budgets and comparative analysis year-to-year. You must know which way you are heading today so file all records systematically for ready reference and refer to them often.

"Oh, stop worrying about what th' mess sergeant will say—we're payin' for this outta our own pocket, ain't we?"

penses for the past three years. It has been found that overhead averages up about the same from year to year in the electrical contracting field so by taking the average for the past three years, we get a safe figure to consider for a forthcoming year. Under present conditions, check this average against the figures for the past 12 months. If the trend shows that your expenses for the past year are much higher, base your estimates on the higher figure. Judgment has much to do with setting budgetary quotas, particularly in times like these when expenses are skyrocketing so keep your estimates as factual as possible by basing them on the past experience figures most likely to reflect future outgo. In this monograph, we outline the physical routine for building a budget. It is up to you to make whatever adjustments are best suited to your case.

Well, the books show that Billings' overhead for the past three years averaged $36,000, sales for the same period averaged $112,000 per year. Gross margins averaged $33,600, or 30 per cent of sales. Right here is one advantage of studying past performance in connection with budget preparation. This contractor's yearly gross margin was $2,400 less than needed to meet his $36,000 overhead expense. So, he has been losing $2,400 yearly, or about 2 per cent of average sales. This loss indicates that Billings has been cutting prices too drastically in an effort to get business. A budget will help him preserve a reasonable share of margin for his net profit and minimize the loss of profitless selling through the checking of estimated against actual figures month by month. Without a budget, the contractor works in the blind month after month and realizes too late that he has gone in the hole.

Billings' weakness is insufficient margin. The 30 per cent gross margin he has been making falls 2 per cent short of covering overhead so that he can, at least, break even. To correct this deficiency, we set up the 1942 budget on the basis of a 35 per cent instead of a 30 per cent gross margin. Next, we budget net profit for 1942. An analysis of the figures in this field shows that 5 per cent is a conservative estimate and budgets must be conservative. The budget build-up now stands:

Estimated gross margin or gross profit	35%
Estimated net profit	5%
Average yearly expense, ($36,000)	30%

If $36,000 is 30 per cent, 1 per cent is 1/30 of $36,000, or $1,206, and 100 per cent is 100 times $1,200 or $120,000. This $120,000 is the estimated sales volume for 1942, which will cover this contractor's overhead expense and net 5 per cent profit. Next, we prepare the master budget.

Net profit (5% of $120,000 sales)	$ 6,000
Overhead (30% of $120,000 sales)	36,000
Gross margin (35% of $120,000 sales)	42,000
Cost of sales, including cost of materials, labor and direct job expense	78,000
Budgeted sales volume for 1942	$120,000

Inasmuch as it has been determined by an analysis of figures for the past three years that 35 per cent on sales is a profitable spread, obviously, the difference of 65 per cent will be the cost of sales, or $78,000. If an electrical dealer is preparing a budget, he follows the same routine only his cost of sales is the cost of appliances sold. Using the $78,000 as a control figure, the contractor may prepare a subsidiary budget covering job costs.

From the master budget, we now prepare the breakdown giving month-to-month figures for sales, expenses, margins, cost of sales, and net profit. In some months, overhead expenses are higher than the average of 30 per cent which was figured as the ratio of expense to sales for 1942. This happens in all businesses because fixed expense, such as rent and depreciation, cannot be reduced in low-volume months.

However, if the contractor keeps within budgetary limits, he will average up safely for the year, even though the ratio of expenses to sales are high in some months. The figures on the accompanying budget chart are set in accordance with previous monthly experience figures, which when totaled give $36,000, 30 per cent of $120,000, the budgeted sales volume.

Arrive at monthly figures for sales volume as follows: say that January sales for the past three years, or any other prior period deemed desirable, average $4,000. This sum is 3.5 per cent of $112,000, the total sales figure determined by past experience, so we use this percentage to compute the budgetary sales for January, 1942. For practical purposes, extend computaton to 1 decimal figure. Budgeted sales for 1942 are $120,000 and 3.5 per cent of $120,000 gives $4,300, the budgeted sales for January, 1942. Do likewise for each month to build up the estimated monthly sales quotas.

(*Continued on page* 44)

Ranges Promoted Effectively In Natural-Gas Territory

By Nat M. Johnson

IN TULSA, Oklahoma, there is a rather unique electric range dealer. It is not a "co-op" and yet is cooperatively owned and managed. Its name doesn't sound like that of a dealer, either, but a very active, aggressive range dealership it is, doing its part to make Tulsa people electric-range-conscious. Tulsa Electric Range Dealers Association is the name — and here's how it came about:

Although at one time there had been as many as fifteen appliance dealers selling electric ranges in Tulsa, for one reason or another most of them had discontinued electrics, and in the early part of 1940 there were but five dealers handling electrics and all of them sold gas ranges also. It was plain that dealers and their salesmen favored gas ranges over electric. Not only were the dealers gas-stove-minded, but so was the public.

As evidence, it may be stated that in April, 1940, 650 gas ranges were sold in Tulsa, and only nine electrics. Dealers did not find electric ranges profitable because they did not maintain adequate stocks and such ranges as they had on hand, for the most part, were out-of-date.

There was not a retail outlet in the city where a prospect could see all models of any one make, which conditon made electric ranges difficult to buy. There was a range saturation of only two per cent in the homes connected on lines of Public Service Company of Oklahoma, and it is no wonder that range manufacturers, jobbers, dealers and the utility company were all dissatisfied with the electric range business.

Year	Ranges Sold	Per Cent Increase
1934	12	---
1935	39	225 %
1936	54	38 %
1937	88	63 %
1938	111	26 %
1939	123	10.8%
1940	133	8.1%
1941*	199	114.0%

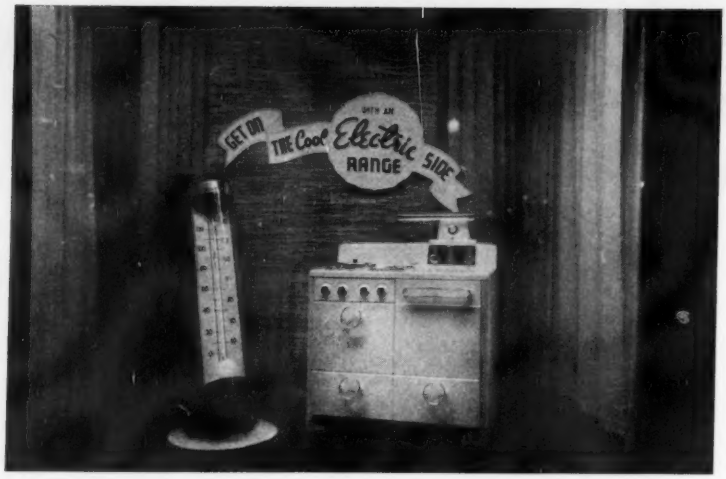
(*First 9 months of 1941 compared with same period of preceding year.)

The trend of electric range sales in Tulsa over the past few years is shown in the table at left.

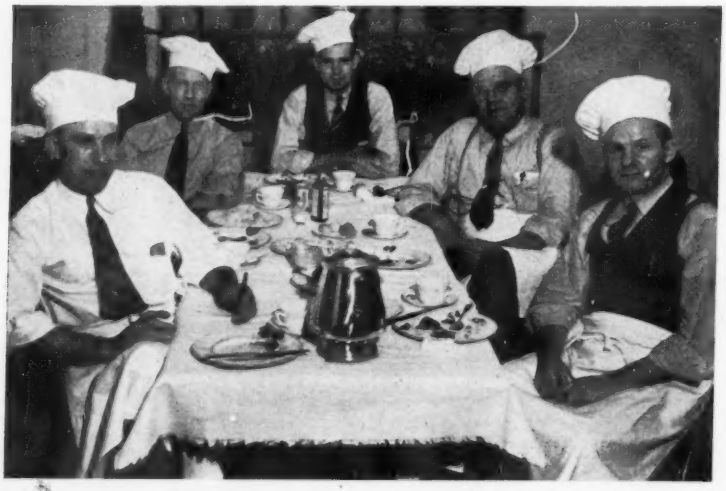
It will be noted that while the actual number of ranges sold increased each year, the per cent increase dropped quite perceptibly, except in 1937, right up to the time the Association was organized in the summer of 1940.

A meeting of factory representatives, jobbers and members of the organization of Public Service Company was called with a view of "doing something about it." The Public Service Company stated frankly that after some ten years of electric range promotional effort, it was somewhat discouraged about the whole matter, but would back up any move sponsored by the factory men, jobbers and retail dealers.

An unusual selling organization is the Tulsa Electric Range Dealers Association. Cooperatively owned and managed, with assistance rendered by manufacturers, jobbers, dealers and utility, the organization is building up acceptance for electric ranges in Tulsa. Shown here is a permanent display of all models of the three different makes promoted by the association. In its first year of operation, range sales by all Tulsa dealers increased 114%.



In addition to the complete range display maintained in the Public Service Company of Oklahoma's building, space is made available to the Association in the display windows of the Public Service Company. This typical display indicates how "use-value" is promoted rather than product name. Below, executives of the Public Service Company and salesmen of the Range Dealers Association are initiated into the order of "Cap and Skillet." Left to right, C. N. Robinson, vice president; E. L. Roggy, salesman; A. T. Cameron, assistant sales promotion manager; W. S. Beam, salesman; and Hobart Brown, sales promotion manager. J. N. Varnell, of Frigidaire, conducted the "Cap and Skillet ceremony.



After several meetings, the association plan (by which retail dealers would provide money to start out two or three salesmen, jobbers would furnish stocks on consignment, and the Public Service Company would take care of advertising and display) was decided upon. Retail dealers were invited to meet with the others, and the plan was outlined to them.

The entire program was designed to make the electric range business profitable for the dealer. It was expected that public acceptance for electric ranges would be developed to such extent that within twelve to twenty-four months, the range business could be turned back to the dealers, and the Association dissolved.

Three retail dealers approved the plan and agreed to finance its start — and the Tulsa Electric Range Dealers Association came into being. The dealers are Brown-Dunkin Company, department store (Frigidaire); Bull Furniture Company (Hotpoint); and Clark-Darland Hardware Company (Westinghouse).

The plan does not exclude the member dealer from electric range sales at his own store. Actually it has stimulated range sales for all dealers, the Association now averaging slightly less than 70 per cent of electric range sales in the city. Dealers were asked to actively cooperate in the promotion of range sales by sending prospects to the two salesmen on the Public Service Company floor and by maintaining one or more samples of ranges in their stores, and to continue their activities in the electric range business much as they had in the past.

In return for this assistance from each member dealer, the Association pays him a commission of ten per cent on all ranges sold of the make which he handles. The dealer has no money invested in stock other than his initial small investment in the Association, unless he wishes to carry some stock in his store; and he has no sales or advertising expense.

A definite location was wanted where a full line of ranges could be shown, and arrangements were made with Public Service Company for the use of its showroom. All models in each of the three lines handled are displayed in the utility showroom and without a doubt this is one of the most complete and finest displays of electric ranges in the entire South. The room is large and air conditioned, and there is a steady stream of company patrons to see the display.

Two salesmen were selected, not alone for their experience in selling electric ranges, but also because of special qualifications in the electric appliance business in general. They are middle-aged men with a real background in selling major appliances. The men are paid a salary plus a commission on their sales. The two salesmen sell any one of the three makes.

Full list price is charged for each range, plus installation charge. The prospect is quoted an installed price. The Public Service Company has always taken care of the installation of the proper size wires to the house, and installs a heavier meter when necessary, then the customer pays for the wiring from the meter to the range. A flat charge is made for this latter.

Ranges can be bought on the customary installment terms and payments can be made in connection with monthly electric current bills.

The merchandising program of the Association is well managed. Radio and newspapers are used. Also, there are direct-mail and

personal follow-ups, store displays, occasional demonstrations and good show-window displays.

In newspaper advertising no price quotations were given at first, such space being devoted to product advertising. However, they gradually worked into prices and terms in the ads. In setting a record of 114 per cent increase for the first nine months of 1941, it was not necessary to make any price concessions. All ranges were sold at list price, installed. The average sale price has been around $165 each.

Factory representatives have been most cooperative in the program. They have given the salesmen and others of the Association special training, from time to time, in using, demonstrating, and selling their ranges. Thus the salesmen and the dealers in the Association qualify as electric range experts.

Oklahoma City Range Campaign Based on "Selective Selling"

EARLY this past summer, the Oklahoma Gas & Electric Company began a "conservative range promotion" program through dealers. Differing from the usual high-pressure, hit-and-miss campaigns of short duration, this is a longer program of "selective selling"; that is, effort is concentrated on people the dealers know can afford to buy and operate electric ranges.

Because of the type of campaign, it was felt quite important that the dealer who participates and as many of his sales personnel as possible use electric ranges in their own homes. Therefore, somewhat better-than-usual terms were allowed the dealer organizations by distributors, and OG&E made full installation allowance, the amount being $17.50 in Oklahoma City, and $15 in the territory, on each such range installation.

Actually, according to T. E. Fielder, manager of the sales development department, the campaign is intended more as a test to see just how much it costs per unit to sell electric ranges in their territory, with future plans and expenditures to be determined by the success of the 1941 campaign. Electric range manufacturers, distributors and dealers in the territory were invited to cooperate in the program, and to submit any plan of their own or one which had been used successfully elsewhere.

Results for the first four months of the campaign indicated the possibilities of a "conservative range promotion" program, the increase in sales being 300 per cent over the same four months of 1940—132 as compared with 33, in units.

Some sixteen or eighteen dealers are participating in the plan, with around twenty ranges having gone into dealers' homes in the first four months. Full cooperation by OG&E goes to the dealer who is using an electric range for reasons which are self-evident.

Mr. Fielder is now expecting even better results than were shown in the first few months.

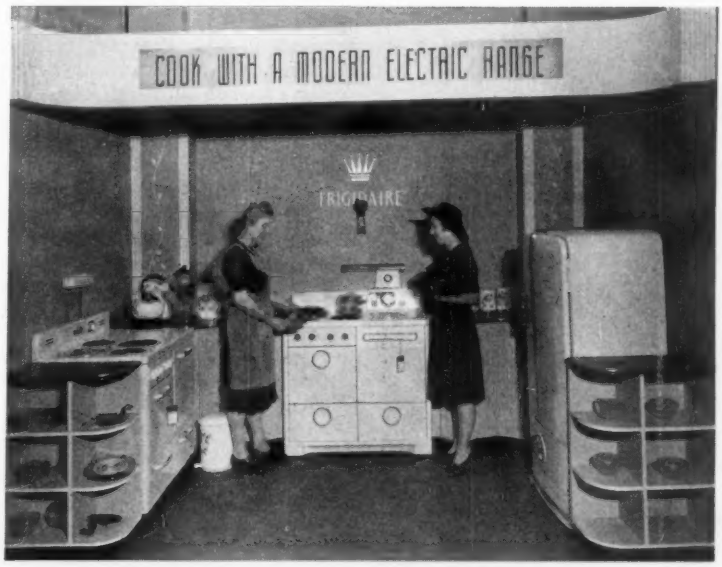
"People are becoming electric-range minded and sales resistance is diminishing," he said. "This has been gained partly through the widespread use of electric roasters or cookers, and partly through the national advertising used by range manufacturers. And the situation is helped somewhat by new people moving into this section from places where there was a heavier electric range saturation."

As part of its plan of cooperation, OG&E installs the usual three-wire service meter and switch cabinet for range circuit, and in addition, allows $10 of an estimated average $17.50 installation cost in Oklahoma City; and $7.50 of an estimated $15 installation cost in the territory, and pays to the dealer or his salesman a cash bonus of $7.50 for each range sold on its lines. However, it is the responsibility of each dealer to service the ranges he sells, OG&E assuming no obligation to service any range.

As a part of their range promotion plan, electric cooking was featured prominently in the Electric Building at the Oklahoma State Fair, held in Oklahoma City the latter part of September. There were four ranges in operation during the "Pin-it-up lamp game" and continual talk about electric cookery. In the game, each player was handed a chocolate muffin fresh out of the oven, with a nice little story on the advantages of electric cooking.

One of the effective dealer displays is located in Brown's Department Store. In this store, near the entrance to the major appliance and house-hold department

(*Continued on page* 28)



An effective appliance display maintained in Brown's Department Store, Oklahoma City. A demonstrator in charge keeps a quantity of ice box cookie dough on hand. While talking to a prospect about the range, she slices off a piece or two and bakes a few cookies to impress the prospect.

Separate Display Facilities Boost Trade-In Sales

THE PROSPECTIVE buyer's old electric or ice refrigerator may be a "pain in the neck" to some electrical dealers, but to the Dade Home Appliance Co., Inc., of Miami, Fla., it only means another sale—plus extra profit on the "trade."

"Locally, at least," says E. L. Simmons, the company's sales manager, "an active demand for major appliances during the past few years obscured the need for paying a great deal of attention to the disposal of trade-ins. Broad-scale home-buying was moving a sizeable portion of our population from furnished apartments to new houses. Usually, the customer had nothing to trade.

"Generally speaking, intensive selling and the introduction of the old 'box' into the picture was a bridge to be crossed when one got to it. However, for some time we have discerned a trend toward larger trading volume, and have set up a simple method to handle it."

In the past year, Dade's ratio of trade-ins to total volume has risen from 20% to 25%. And there is every indication that it will continue to advance.

Good merchandising keeeps used appliances moving. E. L. Simmons, sales manager for Dade Home Appliance Company, demonstrates a reconditioned refrigerator to a prospect.

About a year ago, the firm moved from its former location in the Huntington Building to larger quarters at 1405 Biscayne Boulevard, where it now occupies a store approximately 25 ft. by 75 ft. This is divided into two fluorescent-lighted display rooms and a service section.

The show room at the front of the building displays new merchandise, while the one behind it houses re-conditioned stock. A permanent partition, having a central, arched opening, separates the two rooms from each other. The work shop, of course, is at the rear.

As they are received, used appliances carefully are checked to determine what repairs and replacements they may need. Since the firm's sale of refrigerators is three times as great as its volume on ranges, the former type of appliance represents the bulk of its trade-ins.

Ranges enter into the re-sale problem only to a small extent. Therefore, it is with the re-conditioning and disposal of used refrigerators that the company chiefly concerns itself.

The old business truism, "Well bought is half sold," exactly expresses this company's trading policy. Re-conditioning cost, selling expense and sufficient profit to make worthwhile the trouble of handling a used appliance all are taken into consideration before the allowance price is set.

The re-conditioning part of the program is most thorough. The customer has to get a reasonable return on his investment. He must be well enough satisfied so that he will want to deal with the firm again. That principle, too, is an important part of the merchandising plan.

Refrigerating mechanisms are overhauled to insure proper functioning. When needed, gaskets are replaced. If there is any doubt about it, they are replaced anyway. If properly re-conditioned, these used boxes are salable merchandise.

Here is a typical transaction: recently, the company sold a new 6 cu. ft. refrigerator at $166.75. On the deal a 4 cu. ft. box came in at an allowance of $20. Excellent in appearance, it was badly out of order mechanically.

Its overhauling cost amounted to $8.50, to which later was added $7.45 for selling expenses and overhead, including the cost of delivery to the purchaser. On a cash transaction this refrigerator sold for $49,50. The firm, therefore, made its normal profit on the original sale, plus $13.55 on the trade after all expenses were deducted.

Expert reconditioning makes "trade-ins" readily salable. One of the Dade Home Appliance Company service men is shown recharging a unit with refrigerant.

The company guarantees that the mechanical portions of its re-conditioned refrigerators will function properly for 90 days. If a "prospect" appears skeptical about the amount of use-value, he will obtain from one of them, he may receive a one-year guarantee by paying an additional $5.

While very few customers avail themselves of this option, the offer convinces them of the firm's good faith. The idea is a simple one but it carries conviction and has put the name of more than one "doubting Thomas" on the dotted line.

"Used appliances," Simmons points out, "are liabilities only to the extent that they clutter up the dealer's premises with slow-selling merchandise, which in one way or another cuts into his legitimate profits. Otherwise, they can become stepping stones to bigger volume and better earnings.

"A few years ago a local ice-manufacturing company did a neat job of selling on ice boxes using its product. Better utility service and rates now support our selling effort on the electrical type. But the customer feels that his old ice box should have some value. And we have proven that it has."

Dade Home Appliance trades in these old ice boxes at the rate of two or more per week at prices ranging from $5 to $10. Of course, there is no mechanical overhauling to be done. Usually, however, they need new gaskets and a re-finish job.

To take care of the latter, the company purchased a small elec-

(*Continued on page* 42)

Cashing In on Little Sales

Recognizing the potential value of every contact, this dealer tries to close sales on small appliances, when major deals fail.

THERE is an old adage that a half a loaf is better than none, and this theory has been successfully applied by The Beyer Company, of San Antonio, Texas, in the merchandising of appliances. Failing in the sale of a major appliance, the salesman tells the prospect of the numerous minor appliances that may be enjoyed at a small cost, and if this fails, he tells of their repair service. As a result of this policy, hundreds of contacts have been established and new accounts opened that, otherwise, might have been lost. And, in these contacts are numerous opportunities for future business.

How this has been accomplished makes an interesting story and one which any dealer may read with interest and profit. It is told by A. F. Beyer, himself:

"Some months ago, when I was studying over a group of reports turned in by our salesmen, my attention was called to the fact that, while these men were making a representative number of calls each day, their volume of sales was not what might be expected. Looking further, I noted that many of these reports carried a notation that the prospect was not in a position to assume an obligation of such proportions at this time.

"After mulling over this problem for a time, seeking some plan, some method, whereby we could get better results, it occured to me that many of these calls had failed because we had been shooting too high. In other words, while we had been plugging for sales of the major appliances, we had entirely overlooked the opportunity for establishing a contact through the sale of smaller items.

A. F. Beyer

"As a result of this study, we have now changed our sales plans somewhat and are now giving more attention to the smaller articles, such as electric irons, clocks, toasters, and percolators — with the result that some good business has been created. In addition to this, we have promoted our service, offering to put appliances in good shape where sales were not to be had; and, as a result of this plan, we have been able to make more contacts, to increase the number of sales, the number of new customers, and to add to our list of prospective purchasers of the major appliances.

"When the plan had been worked out, we called in our salesmen, told them what we were doing, and asked their cooperation. We pointed out that even the sale of a minor appliance, or a service job, would establish a good contact and pave the way for better business later.

"We arranged our displays within the store to tie in with this plan. Along the center aisle that leads to the offices, we arranged display tables featuring these minor appliances. Consequently, through this arrangement, persons coming into the store to pay on an account or for other business, were sure to see these displays and to become better acquainted with these appliances. As a result, interest was increased, and sales improved accordingly.

"From the service angle, we specialized in those things that were hard to get. We featured this service and soon the word got around that when special replacement parts were hard to get Beyer would have them or could get them.

"As an illustration of what this did for us, a lady came in and inquired for an unusual type of electric cord. We had none of these in stock and had to look around for several days before we were able to get one of this particular type. But when we had rendered this service, the lady was delighted, and she has given us several good prospects that have brought us some good business.

"This is but one of numerous other instances wherein we have rendered some special service to a customer and have been rewarded by their giving us their own business as well as recommending us to their friends, neighbors and relatives. And these people, in turn, have become our customers and friends.

"Reflecting back over our operations since we adopted this plan, several outstanding accomplishments have been made that have proven its worth. One of the greatest of these is the fact that we have greatly increased the number of contacts, and we can look forward to more business through these contacts in the days to come. We have rendered some services that have been appreciated, and this has helped to build up good will, to make the firm name known among hundreds of prospective customers, and to pave the way for more sales.

"What is probably of greater importance, however, is that we are featuring every phase of our business instead of just a small percentage. Our sales in major appliances have continued to show good returns, but on the other hand, our sales of the smaller goods and the bulk of our service work has gone ahead by leaps and bounds.

"Giving attention to the little sales has increased our business."

MERCHANDISING MEMOS

Spotlighting some pointed appliance sales suggestions

By Roy A. Palmer

Merchandising and Advertising Manager, Duke Power Company, Charlotte, N. C.

THIS has been an unusually good year for most salesmen. More employment, plenty of money in circulation, buying for the future under pressure of scarcity of goods—all of these factors contributed to the excellent sales records. But what about 1942? Priorities, curtailment on manufacturers' output, taxes, and other handicaps rise ominously to create apprehension in the coming year's sales outlook.

Unquestionably, there is reason for the electric appliance salesman to wonder about the future if he plans on carrying on his operations the same as he has done in the past. All phases of business are in a state of flux—and selling is in for its share of change.

To meet these conditions, a salesman must adapt his selling tactics to the new order. If he cannot change, perhaps there'll be a change of salesman! On the other hand, the salesman who shows sincere interest in his job, and exhibits resourcefulness in trying to develop a sales volume in the face of these obstacles, is going to be encouraged to the utmost by his superior executives.

All appliances will be difficult to get in the volume that we would like to have them. As a result, the aggressive salesman will try to sell a greater *variety* of appliances instead of the usual limited number on which he may have specialized in the past. Where he has been selling chiefly to city folks, he will expand his efforts into rural territories. The rapid growth of rural lines during the past few years has created a new market for the appliance salesman. While customers on these lines need and want the usual appliances sold to the urban customer, they also need utility motors, feed grinders, water pumps and a host of other items which might be quite new to the average appliance salesman.

The farm market is interesting not only because it enlarges the number of items which the salesman can sell but also because the government is encouraging the farmer to utilize these labor-saving, economical devices in the interest of national defense. The opportunity may present itself to secure these devices for the farmer when others are not available.

SALES JINGLES
JOHN DOODLE TOOK TO WORRYING- HE WORRIED OVER HITLER — AND WAR AND BLITZ AND POLITICS - HIS SALES KEPT GETTING LITTLER -
LATEST WAR NEWS
HE WORRIED OVER ITALY, THE BRITISH FLEET, THE JAPS - HE GAVE UP PRECIOUS SELLING TIME TO STUDY FOREIGN MAPS —
SALES
AND ALL THESE WORRIES THAT HE HAD, A FINAL ONE BEGAT — HE WORRIED TILL HE LOST HIS JOB - THEN WORRIED OVER THAT!
HELP WANTED

It's not always easy to develop an approach to a rural customer when selling activities have been concentrated on city sales. It usually requires a different selling technique. That doesn't mean that sales fundamentals don't apply. They're exactly the same, but the farmer doesn't react to the same sales arguments as does the urban customer. Straightforward, honest facts, clearly presented without pressure or frills will produce results in the rural market.

I know appliance salesmen who are at the top of their group in both unit sales and dollar volume because they actively cultivate the rural portions of their territory. Others in the same group are receiving smaller commission checks because they can't get themselves to realize the potential market which exists on rural lines.

Be prepared to use your thinking cap and more shoe leather in 1942 if you are to chalk up a successful year. Turn more door knobs and plan to work longer hours. Anticipatory buying which has been done in 1941 plus new taxes in 1942 are going to necessitate more selling effort instead of mere order taking. There'll be a certain volume of appliances available in 1942 but they may not be on hand when we want them. Then turn selling effort on some other item which is available at the time. Also, it will pay good dividends to render a service by repairing and reconditioning existing appliances. No better way can be found to build good will and prospects for new appliances when they become available in quantity again, as well as to retain contact with old customers.

Customer contact is always valuable. Just because some one appliance is out of stock is no sign that we must give up any more than we should give up advertising at such a time. We must continue advertising to keep up our reputation and to maintain recognition among the public for our appliances. So, too, the salesman needs to keep his contacts. Thus the sales curve can be kept at a high level for the year even though at times the lack of appliances may temporarily seem to hold it down.

Practical Questions on the Code

ONE of the interesting features of the recent annual meeting of the Southern Section, International Association of Electrical Inspectors, was the Code discussion with a "panel" of Code authorities to answer all questions that could not be answered by someone in the audience. Questions were submitted in advance, based on actual field experiences. Although the answers obtained do not represent official interpretations, they are authentic because of the broad experience of the men on the panel. Among those who served on the panel were: A. L. Abbott, Lee F. Adams, F. G. Camus, N. E. Cannady, M. M. Brandon, J. G. Fisher, H. N. Pye, Jos. Whitner, V. H. Tousley, C. M. Jones, Geo. Welman, Walter Stall, B. Z. Segall, Howard Weber, and E. C. Knox. Because of the practical nature of the questions answered, we present here a number of the questions and the answers obtained.

1. Question: May open wiring in damp or wet locations be separated from the surface wired over the same as in dry locations?

Answer: No. Section 3205 specifies ½-inch clearance from surface in dry locations and 1-inch clearance in damp or wet locations.

2. Question: (a) Can concealed knob and tube wiring be used in a hazardous location? (b) Can open wiring be used in a hazardous location?

Answer: (a) No. See Article 500. (b) Yes. In Class IV locations under certain conditions.

3. Question: In determining a hazardous location, do you consider the best, worst or average condition?

Answer: A reference was made to Section 5002 for classification and considerable discussion arose. The final thought was that all pertinent factors should be considered by the inspector having jurisdiction before judging the location as hazardous or non-hazardous.

4. Question: When hazardous and non-hazardous locations are separated by a brick wall with unprotected openings, should both areas be classified as hazardous?

Answer: Considerable discussion of this question took place and no definite opinion was reached. However, attention was directed to the definition of "Garages" under Article 100, and the comparison would seem to indicate that both areas should be considered hazardous in some types of classification at least.

5. Question: Is it the intention of of the Code to require Class I wiring systems where within 4 feet of a garage floor?

Answer: No. Only the equipment other than that covered in Section 5103a need be explosion-proof. See Sections 5103a and 5103b.

Remarks: Several members contended that some of the code references on this point do not agree and, therefore, are not fully in accordance with the foregoing answer.

6. Question: Should taps to switches, receptacles and fixed appliances be permitted under Section 2106?

Answer: No.

7. Question: Should Section 2107 be clarified so that the example on page 341 will show actual application of the 80% factor?

Remarks: Considerable discussion took place on this point. A number of inspectors present stated that they are enforcing the 80% factor completely and favored placing the computation in the example on page 341. A motion that the 80% factor be removed and that the wattage per square foot be increased to take care of its removal was made, but no action was taken. It was recommended that apartments be considered the same as single family dwellings as regards the No. 8 minimum service or feeder conductors. (A motion was made to refer this recommendation to the Article Committee and the motion was passed.)

8. Question: Is the color code satisfactory and is it being followed?

Answer: Although a few members objected to the color code on grounds of scarcity of colored conductors, due to government priorities, the concensus was that the color code is satisfactory and is being fairly well carried out.

9. Question: Do members favor expanding the tables in Section 2108a to cover additional occupancies (not listed therein) on the watts per square foot basis?

Answer: A list of the occupancies to be added and the required wattages for each was read and it was pointed out that the watts per square foot required had been carefully computed to give proper capacity for load in each case. The members favor expanding the present tables as outlined.

10. Question: Are the 20 and 25-ampere branch circuits being used for lighting?

Answer: Yes, in manufacturing plants and stores primarily.

11. Question: Would you favor one or more of the 20-25-35-50-ampere branch circuits?

Answer: The majority favored retaining all of these circuits.

12. Question: Are the lampholders permitted under Section 2135a being installed?

Answer: Yes.

13. Question: Would Code recognition of individual overcurrent protection for circuits tapped from large feeders, etc., be desired or helpful?

Answer: Members believe that the present Code now permits this and feel that it is desirable.

14. Question: (a) Why should metal raceway, cable armor, etc., be bonded together? (b) What happens in an insulation failure if bonding is poorly done?

Answer: (a) Bonding is required to assure grounding continuity so that all metal equipment or covering is at ground potential. (b) If bonding is poorly done at a certain point and an insulation failure occurs in the raceway system beyond that point, then the flow of current over the metal raceway to ground would be partially interrupted through the high resistance of the poor bonding connection, and arcing and heating would probably result. Also, the current would probably be so reduced after passing through the high resistance bonding connection that there would not be sufficient current remaining to open the fuse on the circuit.

15. Question: Are wedge lugs required in switch box where service conductors are in electrical

(*Continued on page* 25)

Emergency Conditions Discussed In Oklahoma Conference

INCREASING taxes and operating costs, coupled with heavier demands for electricity to meet national defense needs, did not dampen the spirit of optimism which ran through most of the addresses and papers delivered at two recent conferences of the Electric Light and Power Division, of the Oklahoma Utilities Association. These were held at Muskogee, Oklahoma, October 23, in the Severs Hotel, and at Norman, Oklahoma, October 24, in the auditorium of the College of Engineering, University of Oklahoma.

"Major electric utilities in Oklahoma have a surplus of 114,000 kilowatts of installed electric generating capacity and they stand ready to join in any practical plan to increase this capacity, if necessary, to meet the requirements of the national defense program," said R. K. Lane, president, Public Service Company of Oklahoma, Tulsa, and president of the Association, in addresses before both conferences. The utilities have installed capacity of 402,000 kilowatts, all that really could be expected to take care of normal needs in the state, the speaker asserted.

Surplus Capacity Foreseen

If load growth is normal there will be about 135,000 kilowatts of surplus capacity in the state by 1943, Mr. Lane estimated. He presented details of a proposed plan for electric utilities, all the way from Kansas City to New Orleans, to join with the Arkansas Power and Light Company to furnish 65,000 kilowatts for operating a new aluminum plant, at Camden, Arkansas. If proposed agreements are signed with federal authorities, these electric utilities will pool their generating facilities and make such interconnections as may be necessary to furnish power for an interim period of from 18 to 24 months to the Defense Plant Corporation, which will operate the aluminum plant, until that corporation can complete a new steam generating station.

Mr. Lane said that the arrangement must be predicated on the assumption that the federal power commission will declare the operation an emergency under the federal power act. Two of the participating utilities may have to construct additional transmission lines to cost from $1,000,000 to $2,000,000 and some of the others may have to install additional equipment, if the plan is carried out.

General George A. Davis, executive vice-president, Oklahoma Gas and Electric Company, Oklahoma City, presented the subject "Defense and the Electric Utilities" to both conferences. He said that private industry is now making the chief contribution to public defense and is meeting 90 per cent of these needs. This spirit is being shown in spite of the fact that there are too many men in the federal government who are attempting to carry out socialistic ideas and take over the electrical industry.

For the past several months, electrical production in the United States has been at an all-time high, Mr. Davis said. Such production in July, 1941, was 19 per cent higher than for July, 1940. A recent power survey indicates that much new electric production capacity is all ready for interconnection. He referred to rationing of electricity in some sections of the southeast, upper New York and the northwest, due in large part to drought conditions. He counselled the industry to meet all defense needs and do some long-range planning to take care of increased demands which are expected after the present war ends.

In the meantime, however, the electric industry may have to give up certain classes of business, temporarily, to meet defense requirements.

Difficulties not Insurmountable

"The electric industry has survived many emergencies, including the recent depression, and can come successfully through the present period of mounting operating costs and higher taxes, if it follows the right course," said A. A. Brown, Olahoma Gas and Electric Company, Oklahoma City, in his paper which was read at both conferences by W. A. Darden of the same company, because Mr. Brown was unable to be present.

Despite difficulties in obtaining deliveries of electrical appliances

Newly elected officers for the Eastern District, Electric Light and Power Division, Oklahoma Utilities Association, left to right, are: chairman, Electric Light and Power Division, J. C. Happenny, Oklahoma Power and Water Co.; secretary, M. M. Schene, Public Service Co. of Oklahoma; Eastern District chairman, W. R. Wolfe, Oklahoma Gas and Electric Co.; and retiring district chairman, T. E. Mansfield, Oklahoma Power and Water Co.

and equipment, electric utilities should look at their "hole card" and see if their salvation does not lie in adding business which will utilize the off-peak load. Many utilities can take care of all defense needs and at the same time utilize their off-peak surpluses to supply energy to thousands of electrical appliances which can be taken from home shelves and closets, repaired where necessary, and placed back in use, the paper stated.

Some electric utilities are now operating service trucks which are making house to house calls to bring out these temporarily forgotten appliances, repair them, and encourage housewives to put them back in service.

Mr. Brown's paper asserted that fluorescent lighting may turn out to be a "God-send" in spite of the fact that it has caused some headaches in the industry. A tendency has been discovered to use this type of illumination in the daytime more than incandescent lighting. Then infra-red, or radiant heating, started in 1930, is being utilized increasingly in Oklahoma for finish drying, particularly in paint shops and automobile garages and repair shops, and this is helping to absorb a part of the off-peak load.

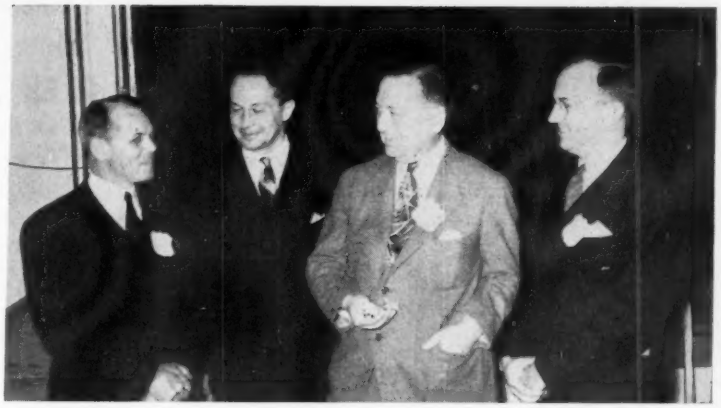
The rapid growth and importance of fluorescent lighting was emphasized more elaborately in papers on "Gaseous Lighting Problems" read at both conferences.

Fluorescent Lamps Discussed

D. J. Frandsen, Public Service Company of Oklahoma, Tulsa, presented this subject at the Eastern District conference. He stated that there has been a phenomenal growth in the sale of fluorescent lamps. He backed this assertion with figures to show that 200,000 fluorescent lamps were sold in 1938, and that such sales increased to 1,600,000 lamps in 1939 and to 17,100,000 in 1940. He estimated that somewhere between 20,000,000 and 30,000,000 fluorescent lamps would be sold during 1941.

Incandescent lighting, however, still has life, the speaker asserted. Production this year, he estimated, will be about 85,000,000 incandescent lamps over last year, and about 156,000,000 over 1939.

The chief problem of the industry is to sell enough electricity to retain present kilowatt-hours and net revenues in the face of increasingly difficult conditions produced by scarcity of certain materials and increasing costs of production and higher taxes.



Among the speakers addressing the conferences of the Electric Light and Power Division, Oklahoma Utilities Association, were: (left to right) Walter Sturrock, General Electric Co., Nela Park; L. A. Wiedman, Oklahoma Gas and Electric Co., newly elected chairman for the Association's Western District; S. B. Williams, editor, Electrical World; and B. E. Lowe, Southwestern Light and Power Co.

This can be accomplished, at least in part, by concentrating on selling "example" jobs to show the advantages of higher standards of illumination. The speaker urged that electric utilities start all over again in telling their story to customers. He displayed a lighting demonstration kit which his company salesmen carry to customers and he delivered a sample sales talk to one of the delegates. He stated that fifty foot-candles should be the absolute minimum installed in commercial or industrial establishments.

Some different phases of fluorescent lighting were presented at the Western District Conference by B. E. Lowe, Southwestern Light and Power Company, Chickasha, Oklahoma. The fluorescent lamp is the most efficient form of lighting yet developed, although it has brought some difficult problems, this speaker asserted. This type of illumination produces from two to two-and-a-half times as much light per kilowatt as the incandescent light. He recalled that fluorescent lighting gots its big start during the 1939 World's Fair when managers of the exposition insisted that this type of illumination be installed because of its special adaptability to color and decorative lighting. From this start fluorescent lighting has developed into a $250,000,000 industry and today shows a potential market of at least $1,000,000,000 for the near future, Mr. Lowe declared.

Among the problems to be solved, the speaker mentioned the so-called "gyp" salesmen of inferior fluorescent lamps and equipment, not now so numerous, and the low power factor element which is being solved by use of power factor correction equipment.

Practical utilization of electrical energy within and on each side of the visible spectrum was scientifically discussed and demonstrated in an illustrated address delivered at both conferences on the subject, "Light in the Laboratory," by Walter Sturrock, General Electric Company, Nela Park, Cleveland, Ohio. These included explanations of angstrom units, cosmic rays reaching the earth from the sky, gamma rays emitted by radium, x-rays, high frequency oscillations, ultra-violet rays, infra-red energy produced by heat, radio waves produced by high frequency generators, fluorescent lighting and other forms and adaptations of electrical energy.

The speaker told about wonders being performed by Mazda lamps using ultra-violet rays and known as germicidal lamp. These are coming into use generally for killing air-born bacteria. Experiments have indicated that respiratory diseases, such as whooping cough, measles, mumps, and scarlet fever, can be checked by sterilizing the air in places where school children assemble. "The opportunities with this lamp alone

(*Continued on page* 41)

Motor Starting on Networks

With the rapid extension of secondary network systems that is taking place, the subject of motor switches for increment starting is one of increasing interest and importance.

By E. S. Lammers, Jr.*

This is the concluding part of a two-part article discussing the requirements entering into the selection of switches for increment starting on network systems. The first part of this article appeared in the November 1941 issue.

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EVERY street car controller is inherently an increment starter in principle, in that the motor is connected to the line through resistance and the resistance cut out in successive steps. As applied to a squirrel cage induction motor, the primary winding or stator winding is connected to the line through resistance and the resistance cut out in successive steps. The principle of bringing the motor up to speed in a series of steps or increments is exactly the same.

Direct current motors and slip ring motors have always required increment starting in some form, and these have always been closed transition starters. Squirrel cage motors have more commonly been started either across-the-line, or else by auto-transformer type of starters, which, inherently, have been open transition in their most general form.

Hence, network requirements have simply enlarged or widened the use of age-old increment starting to the squirrel cage motor. It is important to see this because otherwise there may be the lingering thought that network systems have imposed too severe special requirements on the purchaser or ultimate user.

Possibly such a thought can be traced to the ingenuity of suppliers who have brought out special types of motors to make them applicable within the requirements with only line starters instead of increment starters. Emphasis on these special types may have carried the implication that the rules imposed have made such special types of motors absolutely necessary which is not the case. Modifications have been made in motor design which vary from minor changes in the cage construction to extreme novelties, the latter to a large extent simply transferring the added cost of the increment starter to the motor construction.

It is not the purpose of this article to describe the merits of any of these motor constructions, but it is within the scope of the article to emphasize that network starting permits the use of any of the common forms of induction motors by the simple means of increment starting. The rules and requirements place no limitations on the ingenuity of the supplier and at the same time places no obstacle in the path of the user who wants to stick to conventional designs.

In the application of increment starters, some differentation can be made between high torque requirements and low torque requirements. The curves of Figure 1 refer to a typical high-torque motor such as could be used on a compressor. The motor rating is immaterial here. The motor has a starting torque of 225% and a locked current of approximately 1200 amperes. It is to be started within 300 ampere increments, per step, per step. The motor will not begin to rotate at less than 200% torque. Hence it is necessary to apply full voltage in 4 points of starting (1200/300=4).

On the 4th point, the motor will begin to rotate and accelerate. The torque will follow Curve "A" and the current will follow Curve "B," until the motor reaches normal running conditions which will be 100% torque or less. Curve "C" shows the starting increments in applying full voltage to the motor.

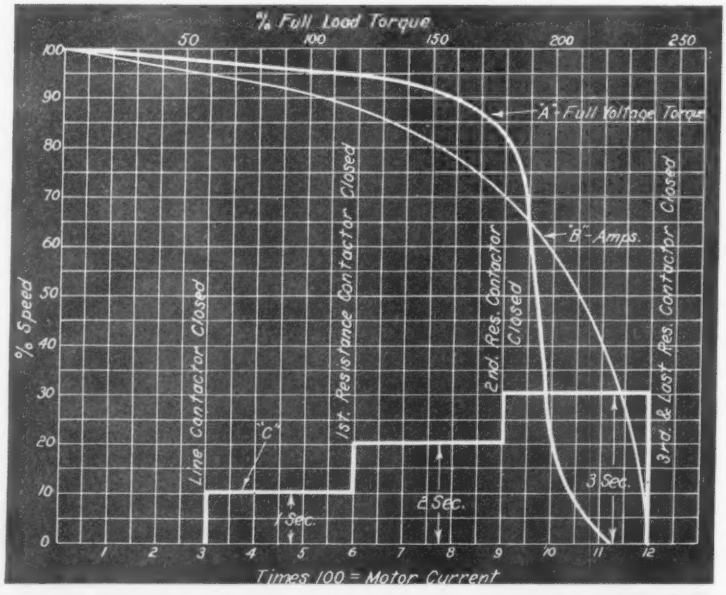

Fig. 1. Characteristic curves of a typical high-torque, Class II motor. Curve "A" indicates approximate speed-torque characteristic at full voltage. Curve "B" indicates approximate speed-current relation for motor having locked rotor current of 1200 amperes. Curve "C" is the time-current curve for 300 ampere increments at 1 second intervals.

*Mr. Lammers is an industrial engineer with the Westinghouse Electric and Mfg. Company, in Atlanta, Georgia.

However, assume a case of starting under low torque conditions, such as a line shaft with all machines on their loose pulleys, or any unloaded machine tool. The curves of Figure 2 are characteristic of a typical low-torque motor. Curve "A" is speed-torque characteristic at full voltage. The torque varies with the square of the voltage and Curve "B" shows the torque characteristic at 70% voltage. Likewise Curve "C" is the speed-current curve at full voltage and Curve "D" at 70% voltage. Note that the current varies directly with the voltage in comparison with the torque varying with the square of the voltage. To illustrate, the starting torque at full voltage is 150%, but at 70% voltage, it is .70 x .70 or 49% of 150% or 73½% of full voltage torque. In comparison, the locked rotor current is 600% of full load current at full voltage but at 70% voltage it is simply 70% of 600% = 420% or full load current.

It can be easily seen from Curve "B," Figure 2, that an unloaded machine requiring, say, only 50% torque could be started easily and accelerated to 95% speed at 70% voltage. In applying line voltage at this point, in closed transition, the current would only increase from point "a" on Curve "D" to point "b" on Curve "C." This is a change from 80% full load current to 120% full load current which is relatively small. However, the actual change would be less than this, for any resistance designed to give 70% voltage at motor terminals at instance of start would gradually increase that voltage as the line current decreased.

It takes two points to get any reduced voltage, and from a cost standpoint there is no choice between high torque and low torque starting within two points. The main difference is in the use made of the controller. For high torque, the object is to get the motor across-line within the increments as quickly as possible so that the motor can start rolling. But with low torque, softer starting would result if the resistor was left in the circuit a longer period to allow the motor to accelerate more slowly.

Next consider the case where a motor requires more than two points for high torque starting: can a point be saved with low torque starting? Assume we are here dealing with a 75 hp motor, rated at 208 volts, 3 phase, 60 cyle, 200 ampere full load current, 1280 amperes locked current, and a starting requirement of 350 ampere increments. The starting torque of the motor is approximately 150%, and the application is a pump with intake and discharge open during starting. The speed-torque requirement is as shown on Curve "E," Figure 2. The horsepower varies with the cube of the speed and the torque with the square of the speed. At instant of start, only frictional losses of about 10% need to be overcome.

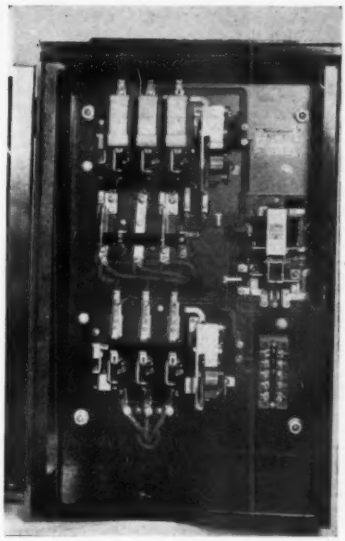

Fig. 3. A typical increment starter of the two-point type having line contractor, one resistance contactor and a timing relay. Resistance is mounted on the back of the panel.

On the first point we can put 350 amperes into the motor. This requires 27½% voltage and the motor would barely start to turn. Obviously, the second point should be closed as soon as permitted. This gives 700 amperes or 55% voltage and a starting torque of 45%, well above the requirements. The motor can now be allowed to accelerate as far as it will go. In as much as the line current reduces as the motor speeds up, the terminal voltage at the motor gradually increases which in this case would allow the motor to accelerate to approximately 90% speed where the motor can be safely connected across line within the increment requirement. From 90% speed, the motor could be connected across the line with one additional point making three points required altogether.

Here is a particular case where one point is saved in the starting of a motor under low torque conditions. This cannot be taken as general for many other factors could nullify this advantage. If this were a constant torque application, and 50% starting torque required, an added point would be needed. The only thing here proved is that there are cases

(*Continued on page* 41)

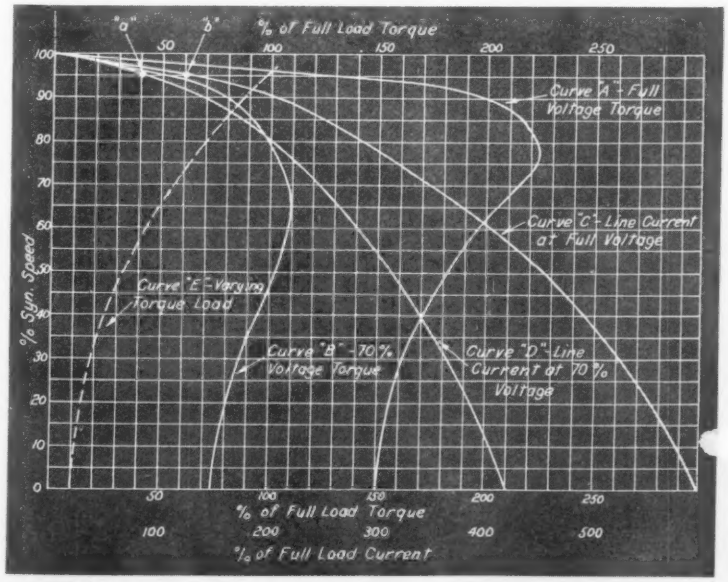

Fig. 2. Characteristic speed-torque and speed-current relations for squirrel cage induction motor at various voltages.

Primary Feeder Voltage Control

Comparative analysis of the relative effectiveness of regulators and capacitors for feeder voltage control.

By F. M. Starr*

THIS is the third and concluding article of a series discussing primary feeder voltage control. The first article, which appeared in the August 1941 issue, presented a general discussion of the problem. The second article, which appeared in the November 1941 issue, analyzed twelve typical cases involving the use of regulators, capacitors, and capacitor switching equipment, in various combinations. In this last article of the series, the discussion is extended to include the thermal capacity released and the reduction of energy losses as a result of capacitor installations.

●

BY CORRECTING the reactive kva on distribution feeders with capacitors, the kw carrying capacity of the circuit is increased because voltage drops on the feeder are materially reduced. On overhead lines, voltage drop is usually the factor which limits the capacity of the line. On the other hand, in cables, transformers, generators, etc., the limiting factor is thermal capacity or amperes.

Correction of reactive kva also reduces amperes and thus releases thermal capacity in all parts of the system to the generator. The released thermal capacity is usually considered as the number of additional amperes (or kva) at the original load power factor which can be added to the load without exceeding the original amperes or kva before correction.

Table IV summarizes the values of released thermal capacity for the twelve cases studied in the second article of this series (see November 1941 issue). Because of variation in load factors, diversities, etc., at different points of the system, these values are approximate only but may be used for estimating released generator, transformer and cable capacitor for the cases considered in this study. No dollar value has been applied to them but, obviously, they will have a substantial value in many cases and will contribute materially to the economies of feeder capacitor applications.

Reduction of Energy Losses

Frequently capacitors are applied on distribution feeders to the degree of correcting for the average reactive kva over a 24-hour period. In many cases, this amount of correction will result in the maximum release in thermal capacity and also the maximum reduction in energy loses which it is possible to obtain because frequently the reaction kva on a feeder is fairly constant over a 24-hour period—much more so than the kw. Under this condition, permanently connected capacitors in a quantity to correct for the average reactive kva will give unity power factor actually at only a few moments a day but the deviation from unity at other times will be only plus or minus 5% or less, and this is insufficient to materially change the reduction in current, thereby insuring a maximum reduction in feeder copper losses.

There are other types of feeders, particularly industrial feeders, where the reactive kva is not at all constant but varies considerably during the day. On this type of feeder, any reasonable reduction in copper losses can be obtained only by switching capacitors out of service a part of each day.

The actual reduction in losses obtained in any particular case varies from nothing at all to something near the theoretical maximum. This theoretical maximum varies with the power factor of the uncorrected load—about 50% for .7 p. f., 36% for .8 p. f., and

Table IV—Approximate Thermal Capacity Released Through Capacitor Installations on Feeders*

Case No.	Per Cent Thermal Release		Kva Thermal Release	
	Plan B	Plan C	Plan B	Plan C
1	—	—	—	—
2	25	—	75.3	—
3	22.7	14.4	102	64.4
4	23.2	—	54.6	—
5	21.8	19.2	98.5	86.9
6	17.3	24.9	116	167
7	24.6	—	77.2	—
8	23.0	25.0	138	151
9	13.6	22.7	128	203
10	20.2	—	95	—
11	12.9	21.5	117	195
12	9.7	17.2	130	230

* For details of Plan B and Plan C, refer to second article in this series which appeared in the November 1941 issue of this publication. Released thermal capacity is considered as the number of additional amperes (or kva) at the original load power factor which can be added to the load without exceeding the original amperes (or kva) before corrective capacity was installed.

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19% for .9 p. f. Possible load reductions at points in the system other than the feeder depend on so many variables that they cannot even be approximated without considerable data. In this connection, however, it must be borne in mind that if switching is used to obtain maximum reduction of energy losses on the distribution feeder, this same switching operation is quite likely to increase the losses in other parts of the system over what they would be had the capacitors remained permanently connected.

If capacitors are switched on a feeder to obtain reduction in losses, in the average case, about 30 per cent reduction may be expected. The output on a typical feeder averages 4000 kwh per year per kva of demand. Feeder losses usually vary from 5 to 10 per cent, a reasonable value being 8 per cent. Actually, they may be as high as 15 per cent on long rural lines. If we assume a value of 8 per cent the annual loss might be expected to be 320 kwh per year per kva of feeder demand. The loss reduction with switching might be expected to be 0.3 x 320 or 96 kwh per year per kva of feeder demand. At 5 mills per kwh, this has a value of $0.48 per kva of feeder demand per year or a capital value of $3.84 per kva of feeder demand. This figure is given here simply as one to keep in mind for rough estimates in case the question of losses is an important consideration.

Table V summarizes the possibilities of reducing loses with and without switching for the particular cases studied in this analysis.

Cost of Capacitor Switch

A switch for switching capacitors must be 3-phase, automatically opened and closed, and actuated by a control device which will hold its calibration, and the responsive element must be adjustable both as to level and band width. To date, switches have gone into service with control devices responsive to voltage, current, or time.

A switch has been available for some time which sells for about $400 (with contact-making voltmeter). Very few of these have been sold, presumably because of the high cost. Considerable time and energy has been devoted to the development of a low-cost capacitor switch. So far the lowest cost device which can be found for 3-phase automatic operation is a street light controller that is equipped with a control device (voltmeter, ammeter or time switch). This switch will handle up to 180 kva of capacitors. Itemized cost is about as follows: cost of bare switch—$126; cost of voltmeter control—$112.50; cost of ammeter control—$150.00; cost of time switch control—$20.00.

Table V—Possibilities for Energy Loss Reductions Without Use of Capacitor Switching Equipment*

Case No.	RKva	CKva Plan-B	Loss Reduction Plan-B	CKva Plan-C	Loss Reduction Plan-C
1	94	213	—	—	—
2	180	228	—	456	—
3	268	242	x	484	—
4	141	213	—	—	—
5	270	228	x	456	—
6	402	242	x	484	x
7	188	213	x	—	—
8	361	228	x	456	—
9	537	242	y	484	x
10	282	213	x	—	—
11	540	228	y	456	x
12	804	242	y	484	y

x—Substantial reduction in feeder copper losses should be realized here by switching.

y—Substantial reduction in losses is likely to be realized here without any switching.

* For details of Plan B and Plan C, refer to second article of this series which appeared in the November 1941 issue of this publication.

Practical Questions and Answers on the Code

(*Continued from page* 19)

metallic tubing?

Answer: Referring to Section 2572b, one member of the panel stated that wedge lugs are not required.

16. Question: Does the Code permit grounding to a gas pipe?

Answer: Yes, but not if water pipe is available, and only if it is a continuous metallic underground gas piping system with grounding connection made on the supply side of the meter.

17. Question: Does the Code require that a combination circuit and equipment grounding conductor be of copper or other non-corrosive metal?

Answer: Yes. See Section 2591a.

18. Question: Can a portion of the service conduit or switch box be used as a path to ground of the neutral service conductor?

Answer: No.

Remarks: Considerable discussion took place as to grounding at the meter socket by means of metal collars which contact the metal shell of the meter socket and extend through a portion of its base to the neutral service conductor. One of the REA inspectors pointed out that this practice has been discontinued by the REA due to poor grounding connections resulting. Such a connection is a violation of the Code.

19. Question: Does Section 2523 mean that a neutral conductor shall be provided in all service drops for grounding purposes on the premises served whether for power circuits only or otherwise?

Answer: Yes, but this is a technical point and probably not the intent of the Code. The neutral conductor would not be required if the distribution system does not supply lighting loads.

20. Question: Is it necessary to ground the frames of portable equipment?

Answer: Yes, if covered under Sections 2545 or 5111.

(*More questions next month.*)

MOTOR Service

Effect of Frequency Change On Motor Characteristics

By A. C. Roe

Electric Motor Engineer
Westinghouse Electric & Mfg. Co.

THE EFFECTS of slight frequency changes on the operating characteristics of lap-wound induction motors are indicated in the accompanying table. The major factors of motor performance are listed together with the effects resulting from both a five per cent increase and a five per cent decrease in frequency.

With a constant load, a five per cent or other small change in frequency up or down has very little effect on the current and copper losses. Core losses will vary directly with frequency changes. Likewise windage and friction losses vary in direct proportion.

The speed will vary directly with the frequency, while the per cent slip is practically unaffected. The power factor and efficiency will increase or decrease slightly with the increase or decrease in frequency as these two items are dependent upon voltage conditions which a change in speed affects.

The maximum and starting torque decreases about ten per cent with a five per cent increase in frequency. Likewise the torque will increase 11 per cent with the five per cent decrease in frequency. This condition is due to the over and under voltage conditions brought about by the speed change, as reduced speed at normal line voltage has the same effect as operating the motor on overvoltage.

The starting current will decrease almost in the same proportion that the frequency or speed increases or will increase with decreased frequency. This again is traceable to over and under voltage conditions resulting from changes in speed.

The temperature rise at full load, maximum overload capacity, full load current, and magnetic noise will decrease slightly with an increase in frequency and will increase slightly when the frequency is decreased.

The conditions listed in Table 1 would be aggravated if the per cent change in frequency was greater and no attempt made to correct conditions by changing the voltage or turns to obtain correct voltage balance in the winding.

Connecting Diagrams for Lap-Wound Motors

THIS ARTICLE presents the twelve-pole, three-phase, six-parallel star and delta three lead connecting diagrams, and the twelve-pole, three-phase, three-lead, twelve-parallel star and delta connections.

The twelve-pole, three-phase, three-lead, six-parallel star connecting diagram is shown in Figure 69 which has three line lead rings, each with six taps; eighteen short pole phase group connectors; and one star ring with eighteen taps. To convert such a connection to a six-parallel, delta, three-lead connection, cut off the taps from groups 4, 10, 16, 22, 28 and 34 from the star ring and connect them to the C line lead ring. Likewise, cut off the connection from the star ring of groups 6, 12, 18, 24, 30 and 36, and join them to the B line lead ring, finally cut off the taps from groups 2, 8, 14, 20, 26 and 32 to the star ring and join them to the A line lead ring. Remove the star ring and there remains the six-parallel delta connection.

The twelve-pole, three-phase, three-lead, six-parallel delta connection, shown in Figure 70, has eighteen pole phase group short jumpers and three line lead rings, each with twelve taps to it. To convert this connection to a six-parallel star connection, first cut off the line lead connections from groups 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34 and 36. Then add a star ring and join all eighteen of these taps to it.

The twelve-pole, three-phase, three-lead, twelve-parallel star diagram, Figure 71 (page 28), has three line lead rings, each with twelve taps to it, and one star ring that has thirty-six connections to it or one from each pole phase group. To convert this connection to a twelve-parallel delta, disconnect the taps from the star ring in three groups as follows: first disconnect those from groups 1, 4, 7, 10, 13, 16, 19, 22, 25, 28, 31 and 34 and connect them to the

Effect of Frequency Variation on Motor Characteristics

Motor Characteristics	Frequency Variation	
	5% Increase	5% Decrease
Per Cent Slip	Practically No Change	Practically No Change
Syn. or Full Load Speed	5% Increase	5% Decrease
Power Factor	Slight Increase	Slight Decrease
Efficiency	Slight Increase	Slight Decrease
Starting Current	5½% Decrease	5½% Increase
Starting & Max. Torque	10% Decrease	11% Increase
Temp. Rise, Full Load	Slight Decrease	Slight Increase
Max. Overload Capacity	Slight Decrease	Slight Increase
Full Load Current	Slight Decrease	Slight Increase
Magnetic Noise	Slight Decrease	Slight Increase

C line lead ring. Next, disconnect those from groups 3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 33 and 36, and connect them to the B line lead ring. Finally, disconnect the star taps from groups 2, 5, 8, 11, 14, 17, 20, 23, 26, 29, 32 and 35, and connect these to the A line lead ring. Remove the star ring.

The twelve-pole, three-phase, three-lead, twelve-parallel delta diagram is shown in Figure 72. This connection has three line lead rings, each with twenty-four connections to it. To convert this to a twelve-parallel star connection, add a star ring. Then, starting with the C line lead ring, disconnect the taps from groups 1, 4, 7, 10, 13, 16, 19, 22, 25, 28, 31 and 34, and connect these to the star ring. Next disconnect the taps to the B line lead ring from pole phase groups 3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 33 and 36, and connect these to the star ring. Next, disconnect the taps to the A line lead ring from groups 2, 5, 8, 11, 14, 17, 20, 23, 26, 29, 32 and 35, and connect these to the star ring.

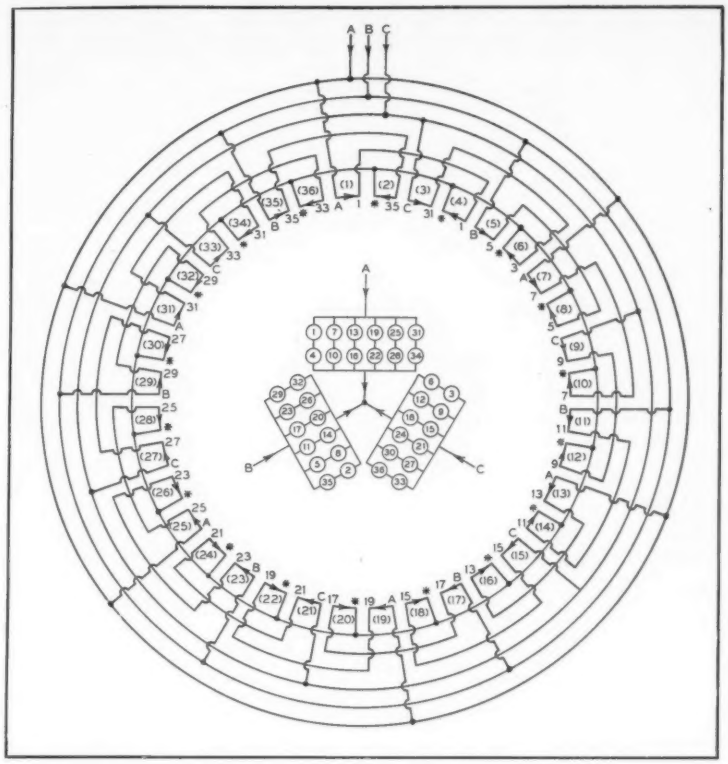


Fig. 69. Six-parallel star connection diagram for 12-pole, three-phase lap-wound induction motor with three leads.

Convenient Test Lamp For Service Men

A test light should be part of every service man's equipment enabling him to test continuity of circuits, blown fuses, etc. The light is usually composed of a weather proof socket and a 220-volt lamp. If enough tape is criss-crossed on the bulb, it may last for several days before being broken, but it is soon necessary to replace the bulb if it is carried in the tool box. When the bulb is good, such a tester adequately serves the purpose of checking blown fuses or hot circuits, but should you care to test the continuity of the element in a range oven unit, percolator, iron or any other such test, where the current would have to be brought to the test, then other arrangements must be made, such as the use of a set of auxiliary leads.

A small compact little test light that can serve the purpose of making a continuity test on both a hot or dead line and has the bulbs semi-concealed to eliminate breakage is shown in the diagram. The idea is to use a small wooden box similar to a thin cigar box but much smaller. Two miniature range pilot light 110-volts sockets and lamps are installed in series in the box. The use

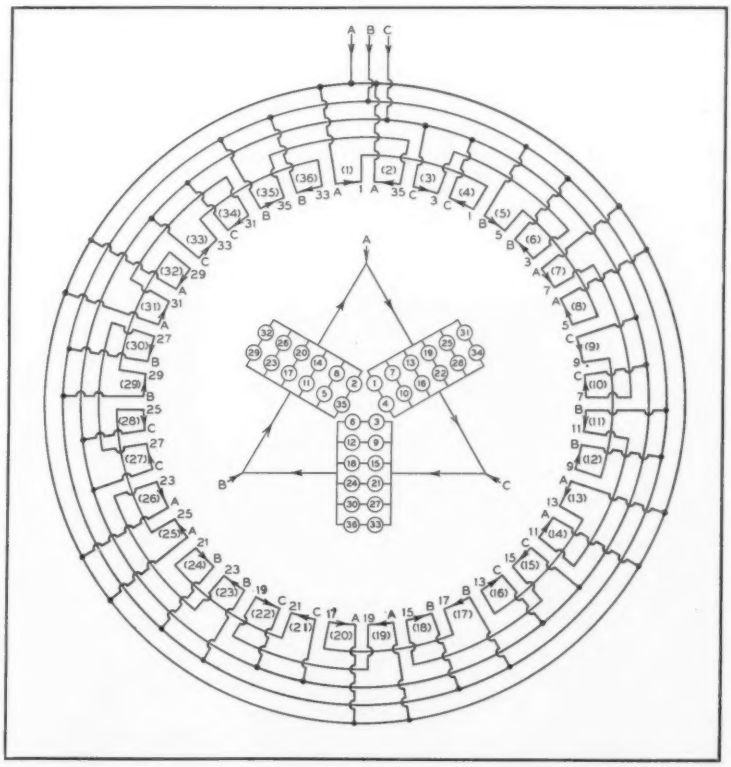


Fig. 70. Six-parallel delta connection diagram for 12-pole, three-phase lap-wound induction motor with three leads.

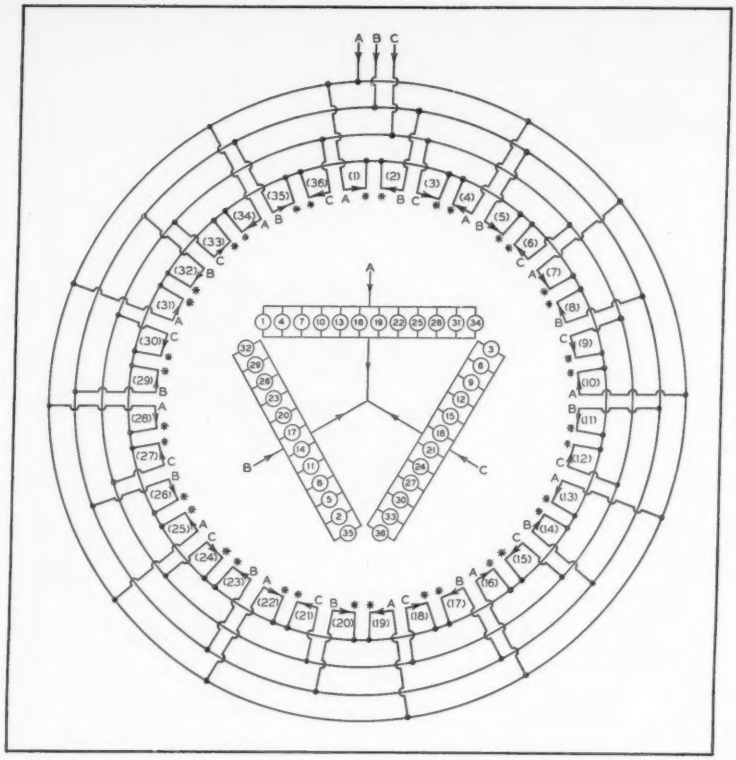


Fig. 71. Twelve-parallel star connection diagram for 12-pole, three-phase lap-wound induction motor with three leads.

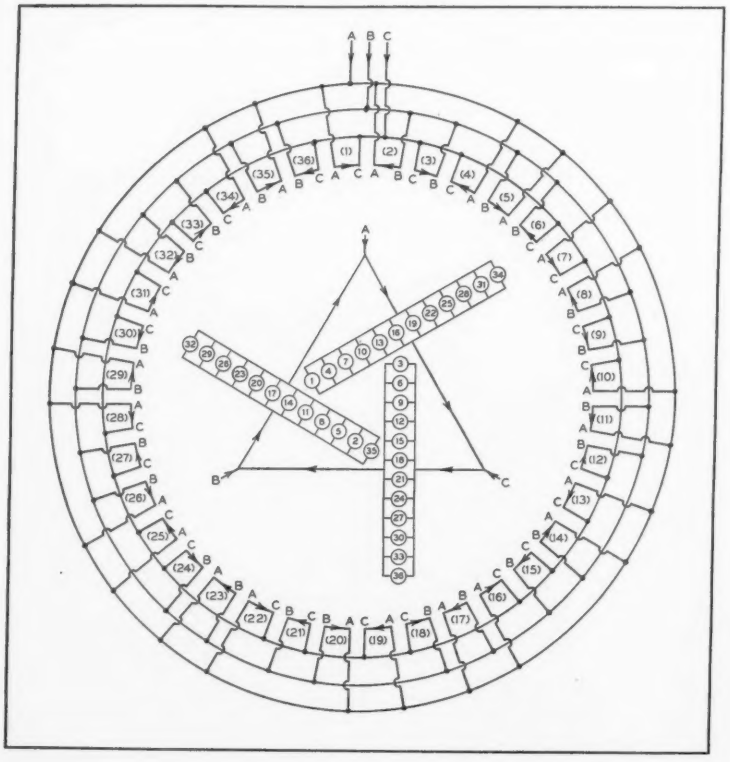
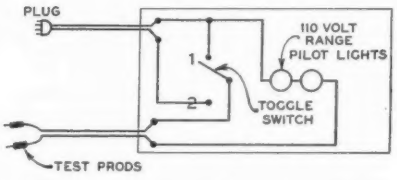


Fig. 72. Twelve-parallel delta connection diagram for 12-pole, three-phase lap-wound induction motor with three leads.

of two lamps eliminates burn outs on 220 volt tests. With small holes in the box lid, they are visible when the box is closed, yet not subject to mechanical damage. A small two-way toggle switch is installed flush in the lid. Then with the installation of two sets of leads (see the accompanying diagram), one set with an attachment plug that might be plugged into any light socket and the other prepared as test prods, either test can be made by merely inserting or removing the attachment plug and flipping the toggle switch to the right position.



Connection diagram of convenient two-position test lamp for service men.

As a little extra refinement, a small socket may be installed in the box so that the leads with the attachment plug on it may be plugged in or out as desired. For the sake of appearance it is suggested that the box have a finish applied, of either black enamel or lacquer, and be rubbed down to the appearance of bakelite.

"Selective Selling" Features Range Campaign

(*Continued from page* 15)

on the street floor, there has been set up a kitchen display booth, containing two models of electric ranges, an electric refrigerator and other appliances.

Mrs. Mabel Anderson, a woman of long experience in cookery, is in charge of the booth. She is there to give a convincing demonstration to prospects, to follow up by visit into the home of a prospect, and then to instruct the new owner after the sale. She goes out as a range and cooking expert from Brown's.

In the refrigerator at the booth she keeps a roll of dough for ice box cookies. She can cut off a few slices and bake the cookies while talking to a prospect.

Following each dealer's range sale, an OG&E home service girl goes out to the home and presents the customer with a "Reddy Kilowatt" cook book.

NEWS of the INDUSTRY

Emergency Building Conditions Discussed by Adequate Wiring Groups

"SHOTGUN" wiring is out—in even the smallest low-cost home built under the priorities system.

This idea was evident throughout discussions on "Adequate Wiring in Low-Cost Home Building," held November 12 at the Raleigh Hotel, Washington, D. C., in connection with the Sixth Annual Conference of the International Association of Electrical Leagues. Detailed planning of the wiring layout, detailed specifications and bills of material were declared an essential industry service to the home builder, home financing institutions and governmental agencies during operations of the homes for defense program.

That the electrical industry's experience in working with builders of low-cost homes during the past two years would be welcomed for its practical value to those locally responsible for interpreting priorities procedure was reported at this meeting and emphasized at the four District Wiring Conferences previously held at Kansas City, Columbus (Ohio), Dallas and Chattanooga.

The dominant theme of all these meetings was that while it may not now be possible to wire a house adequately according to the industry's minimum standards, intelligent planning of the wiring in home building under priorities will have a bearing on future salability and safeguard the interests of home financing agencies by assuring installations with provisions made for future additions essential to adequacy.

Scores of wiring specialists and others active in local A. W. programs attended. Special conference features were the presentation, at a luncheon or dinner arranged for architects, builders, bankers and representatives of Government agencies interested in housing, of the industry's desire to cooperate in "The Electrical Job in Home Building Under Priorities." A. E. Schanuel, field representative of the National Adequate Wiring Bureau, addressed the meetings on this subject.

Electric League Conference

Approximately 60 League managers and others who were present at the wiring session of the Washington Conference of the International Association of Electrical Leagues, took part in the discussions which were highlighted by a report of the work of the A. W. Bureau of the St. Louis Electrical Board of Trade which is performing a definite service in the Homes for Defense program by laying out individual wiring plans in conformance with the OPM provisions. In commenting on this service, P. E. McCaughey, field engineer at St. Louis, stated that there was a definite realization on the part of those responsible for the home building priorities program that a house intelligently wired would assure:

1. The possibility of saving in current consumption.

2. The possibility of preventing electrical obsolescence in the home over a period of years.

3. Recognition that people who do their own work are dependent on electrical appliances and require practical wiring systems to operate them.

4. Provision against the development of a bottleneck in serving the additional appliances that will be wanted and available in the post-defense period.

During the morning session, which was presided over by C. H. Christine, secretary-manager of The St. Louis Electrical Board of Trade, the conferees heard a brief address of welcome by J. S. Bartlett, IAEL president, and talks on "Experiences with FHA Title VI Homes," by C. V. Dunn, technical advisor, Wiring Promotion, Kansas City Power and Light Company; "The Camden Plan," by R. T. King, secretary, Central Jersey

OPM and other government officials addressed this Southwestern Adequate Wiring meeting in Dallas.

Electrical League, and "Electrical Performance Savings with Adequate Wiring in Low-Cost Homes," by Mr. McCaughey.

In addition there were brief presentations on the general subject of "The 'Adequate Wiring Builder' in the Low-Cost Home Field," by E. P. Zachman, business manager, Cincinnati Electrical Association; W. O. Zervas, managing director, Electric League of Indianapolis; J. Carl Fisher, illuminating engineer, Lighting Service Department, Consolidated Gas, Electric Light & Power Company of Baltimore; and C. M. Fife, sales promotion manager, West Penn Power Company, Pittsburgh.

In addition, a paper on this subject prepared by C. B. Osborne, past president, Electric League of Chattanooga, was read in his absence.

Guests, representing Government agencies concerned with home building, who were present at the IAEL convention banquet were:

Sullivan W. Jones, in charge of housing priorities, Office of Production Management; F. Stuart Fitzpatrick, manager, Construction and Civic Development Department, United States Chamber of Commerce; H. T. Daugherty, Industry Section, Federal Housing Administration; Howard P. Vermilya, director of the Technical Division, Federal Housing Administration; A. C. Shire, director, Technical Division, United States Housing Authority; Marvin Raskin, executive assistant to James Cramer, director of priorities, Division of Defense Housing Coordination, Office for Emergency Management, and V. C. Kylberg, Office of Production Management.

Following a brief outline of the IAEL organization and its relationship to the National Adequate Wiring Bureau and the wiring program by President Bartlett, and Mr. Schanuel's address, each of the guests described the work of his agency in connection with defense housing. The meeting was then opened to a discussion period during which the guests answered questions.

Southwestern Conference

Twenty-five conferees from San Antonio, Houston, Fort Worth, Dallas, Fort Smith (Ark.), Arlington (Texas), and several other points attended the meeting at Dallas on November 4 which was under the chairmanship of P. M. Rutherford, secretary-treasurer of the Dallas A. W. Committee. R. C. Dickson, residential sales manager of the Dallas Power & Light Company, presided at a luncheon at which the following were guest speakers:

L. S. Green, chief examiner for housing priorities in the Dallas region; Lewis Storey, architectural examiner, FHA; J. B. Joyce, assistant regional director in the Priorities Division of OPM; L. L. Sisk, informational director for the Office of Emergency Management.

TVA Wiring Conference

The conference at Chattanooga on November 7 was sponsored by the Electric League of Chattanooga and featured a dinner meeting at which the League had as its guests a number of prominent architects, builders and bankers. The sessions were opened by T. R. McAfee, League president.

Dallas Club Program Features MK&T President

The regular weekly meeting of Dallas Electric Club, Dallas, Texas, on October 27th, was turned into a joint gathering with the Dallas Chamber of Commerce, to hear an address by Matthew S. Sloan, president of the Missouri-Kansas-Texas Railroad.

W. B. Clayton, district manager of the General Electric Company and vice-president of the Dallas Electric Club, was program chairman and master of ceremonies. He and Mr. Sloan attended Alabama Polytechnic Institute at Auburn, Ala., at the same time.

Mr. Sloan was anything but pessimistic over the future. He said that regardless of how deep we get into the present world conflict, our country will go on manufacturing munitions and implements of war for some time to come. There will be the manufacture of ships to replace those which will be sunk; the Government has changed its attitude toward small industries and is giving them a break in defense contracts and in other ways; and after the war, Europe will look to America for much of its rehabilitation—the speaker gave as reasons to think the future is not so dark. And he said that American statesmanship will keep us from having another depression after the war ends.

During the luncheon, George L. MacGregor, president of Dallas Power & Light Co., and president of the Dallas Electric Club, presented Mr. Sloan with an "Award for Inspiring Leadership," which included honorary life membership in the club.

Louisiana Dealer Occupies New Quarters

Described as having the largest stock of electrical appliances in southwest Louisiana, the new store of Raymond-Hunter, Inc., was formally opened in Crowley, La., October 25th.

The firm is owned by John Raymond and John Hunter. It is situated on Parkerson avenue. A radio repair shop is being operated in connection with the new store.

Mathew S. Sloan, president of MK&T railroad, receives "Award for Inspiring Leadership" from G. L. MacGregor, president of Dallas Electric Club, while W. B. Clayton, vice-president of the club, looks on.

Blackout To Be Lifted In Southeastern States

Following an all day meeting in Atlanta in the last week of November with representatives of the major public and private utility systems in the Southeast, the OPM Power Branch staff announced indefinite postponement of the pending 30 per cent power curtailment of large commercial and industrial consumers in six southeastern states and definite assurance of relaxation, beginning December 15 at the latest, of the blackout restrictions now in effect.

The following provisions of the OPM Power Limitation Order must, however, be continued in full force and effect:

1. Freezing of consumption at September levels of large commercial and industrial consumers in Georgia, Alabama, Tennessee, Eastern Mississippi, Southeast South Carolina, and Northwest Florida.

2. Power pooling arrangements for maximum deliveries of power into the shortage area.

3. Strict compliance with blackout restrictions until December 15 or such earlier date as may be announced later.

Precise arrangements for the relaxation of the blackout will be announced later.

Relief from the power curtailment program was made possible by several favorable developments. Most effective was a heavy general rainfall over the region which yielded approximately 119,000,000 kilowatt hours of power.

The power pooling arrangement is now bringing into the shortage area more than 40,000,000 kilowatt hours a week. This is nearly 13,000,000 more than the highest amount brought in prior to the pooling provisions made mandatory under the OPM Order.

Increased fuel generation has accounted for an additional 2,100,000 kilowatt hours a week.

Concurrently with the increase in the region's power supply by rains and improved power pooling, power consumption was reduced by more than 11,000,000 kilowatt hours a week through the blackout, voluntary curtailment, and freezing consumption of large consumers. Consumption Nov. 21-27 was 11,600,000 kilowatt hours less than it was the week ending October 25, the last week before the OPM order was issued.

EMERGENCY SUBSTATION—When a power substation fails, it is necessary to do something about it very quickly, and this 4-wheel Fruehauf trailer unit serves just that purpose. On this trailer is mounted a complete emergency substation. The tractor hauls it to the distressed area and leaves it there while it goes about other duties. The equipment on the trailer is sufficient to take the place of the crippled substation until it is repaired. (Westinghouse photo.)

Appalachian Company Wins Water Systems Contest

The Rural Service Department of the Appalachian Electric Power Company, Bluefield, West Virginia, Division, received the first award of $150 for the best report on the promotion and sales of electric water systems, from February 1st to July 31st, 1941, in a contest sponsored by the Electric Water Systems Council. The company's entry was submitted by L. L. Koontz, Rural Supervisor.

Reports were judged on the following merit ratings: comprehensiveness of promotional and sales activities, 60%; cooperation with manufacturers and dealers, 25%; illustrative material, 10%, and clarity of presentation, 5%.

Among the activities of the Appalachian Electric Power Company in its water systems promotion were the use of a display coach and trailer demonstrator; electric water system training schools for dealer salesmen and agricultural agents; continuous direct mail promotion; water system displays and demonstrations at county fairs and other meetings; close cooperation with manufacturers and distributors in establishing active water system outlets; the devolpment of a portable low-cost irrigation system; and a cooperative promotion that netted 1.8 electric water system installations per working day.

Prompt Re-employment of Returning Soldiers Urged

The patriotic cooperation of all employers in seeing that returning soldiers are given prompt and proper civilian employment has been uged by Brig. Gen. Lewis B. Hershey, Director of Selective Service. While pointing out that the selective service system has developed a re-employment program that functions primarily through its local board, General Hershey stressed that its successful operation also depends largely upon the full cooperation of the nation's employers.

Former employers of these returning soldiers are required by the Selective Service Act to restore them to their former positions or to positions of like seniority, status and pay, he pointed out, and likewise have a high moral and patriotic responsibility for doing this. Further, it will help greatly to build up and maintain the morale of the men who have been taken into military service, if it becomes known to them that it will be made easy for them to resume their civilian status at the expiration of their period of service.

Priorities Applications Aided by Field Offices

Seven new field offices of the Priorities Division of the Office of Production Management were opened in October, it was announced by Donald M. Nelson, director of priorities. With the addition of these new offices, the Priorities Field Service offers the assistance of thirty-four district managers, and their staffs, to businessmen and industrialists, in problems arising in the application of the priorities system.

The addresses of the Southern and Southwestern offices, and the names of the district managers who are in charge of them, follow:

Baltimore, Maryland
Baltimore Trust Building
Theodore M. Chandlee, District Manager

Charlotte, North Carolina
Liberty Life Building
J. E. MacDougall, District Manager

Jacksonville, Florida
Hildebrandt Building
George H. Andrews, District Manager

Houston, Texas
Federal Reserve Bank Building
George L. Noble Jr., District Manager

Knoxville, Tenn.
Dyer Butterfield, District Manager

Louisville, Ky.
Todd Bldg. 4th & Market St.
James T. Howington, District Manager

Memphis, Tenn.
Sterrick Bldg.
J. S. Bronson, District Manager

Nashville, Tenn.
1015 Stohlman Bldg.
George S. Gillen, District Manager

New Orleans, La.
John A. Bechtold, District Manager

Oklahoma City, Okla.
Federal Reserve Bank Bldg.
C. F. Aurand, District Manager

Richmond, Virginia
Federal Reserve Bank Building
Fred P. Wilmer, District Manager

San Antonio, Texas
415 W. French Place
Carl L. Pool, District Manager

Fluorescent Lighting School Conducted in New Orleans

A fluorescent lighting school, believed to be the first held up to that time in connection with the traveling Fluorescent Futurama of the big electrical manufacturers, was held at New Orleans November 4, 5 and 6 and proved highly gratifying, according to those in charge.

The school was featured by lectures by Oscar P. Cleaver of the Westinghouse commercial engineering department, and Frank B. Lee, division engineer of General Electric, at St. Louis, and attracted a daily attendance of more than 75 electrical contractors and others connected with the lighting industry.

The Futurama itself was attended by nearly 5,000 persons by actual check (4,720 to be exact) and was pronounced successful on three counts by representatives of the Louisiana Power and Light Company and the New Orleans Public Service, Inc., which sponsored the event for the New Orleans area. These were the school, the location and appearance in the grand ballroom of the Roosevelt hotel, and the industrial and commercial appeal given it, it was pointed out by spokesmen for the sponsors.

The school on fluorescent lighting was opened by E. N. Avegno, manager of dealer sales for the New Orleans Public Service, Inc. It included a talk on some phase of fluorescent lighting and general discussions with question and answer periods on each of the three days. These were declared to have definitely placed fluorescent lighting in a better understood position with many contractors and dealers of New Orleans who attended.

The first day, for instance, "Fluorescent Lamps, Auxiliaries and Their Performance," was the subject. The second day's subject was "Installation, Design and Layout for Fluorescent Lighting Applications," while "Promotion, Sale and Further Application Problems of Fluorescent Lighting" was the symposium subject discussed for the final day.

L. O. Fryer Appointed Graybar Dallas Assistant Manager

On November 10, Mr. Fryer took up new duties as assistant manager of the Dallas office of the Graybar Electric Company. Operations of five branches located at Houston, San Antonio, Fort Worth, Beaumont, and New Orleans are directed from the Dallas main office.

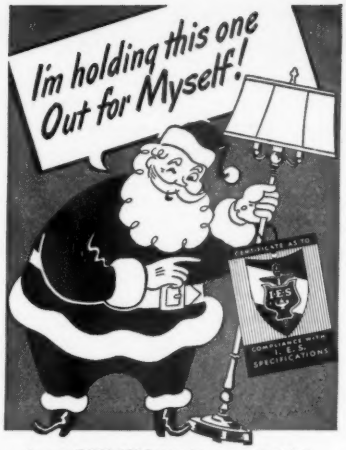
Mr. Fryer joined Graybar in 1922, serving consecutively as accountant, service manager, and finally sales manager of the San Francisco office. Since October, 1940, he has been secretary to the General Sales Committee at the company headquarters in New York.

Ralph Thornton Named Distribution Engineer

Ralph Thornton, for the last six years division engineer of the Arkansas Division, Oklahoma Gas and Electric Co., was transferred to Oklahoma City to assume the position, effective November 15, of distribution engineer of the General Office Engineering Department, succeeding V. A. Pendleton, resigned.

Mr. Thornton's service with OG&E dates from May, 1923, when he was employed as a part-time student in the Norman office. From there he was transferred to the Construction Department for a year, and thence to the General Office Engineering Department in 1926. He was transferred to the Arkansas post in 1935.

Arthur Cox, central division engineer, was named division engineer of the Arkansas Division, effective the same date.



In over 5,000,000 homes I've seen Certified I.E.S. lamps providing Better Light for Better Sight . . . so this year I'm giving myself the lamp with the I. E. S. Tag! But you can get one, too! Be sure it bears the Tag.

I·E·S *Better Sight* LAMPS

IES Advertising Campaign

The 1941 IES fall advertising program is the most comprehensive advertising campaign from the standpoint of number of magazines used, that IES has ever had. It embraces 23 leading magazines and weeklies. Totals over 120,000,000 circulation impressions, or single advertisements. It is the most sustained campaign ever put back of IES lamps. Reproduced here is typical copy that will be used in the advertising campaign.

Brand Resigns from Committee On Interior Wiring Design

E. A. Brand, of Buffalo Niagara and Eastern Power Corp., Buffalo, N. Y., has tended his resignation as chairman of the Industry Committee on Interior Wiring Design. Press of company work and of other committee activities has made the step necessary, Mr.

Brand said in a recent letter to members of the committee. The committee, which includes members from all branches of the electrical industry, produced the Handbook of Interior Wiring Design, which has made a place for itself in the electrical and construction industries.

The work of the committee will continue under the able leadership of Allan Coggeshall, who has been vice-chairman. He will guide the activities at least until the next regular meeting for election of officers in January, 1942.

Last winter the Technical Subcommittee revised the complete text of the Handbook in the light of recent technical developments and in conformity with the 1940 National Electrical Code. Since the standards for general occupancies lean rather heavily on the Code, and since it is believed that the wire tables and wire types of the 1940 Code will probably be revised for the 1943 edition, it was felt best not to reissue these standards at the present time. However, the National Adequate Wiring Bureau has requested that, if possible, the residence standards be revised and reissued as soon as possible, so that the Bureau may take advantage of the changes proposed by the Technical Subcommittee.

Electricity in the News

Poultry raisers in Chowan county, North Carolina, told REA officials they had been able to double their flocks since their farms were wired for electricity. Income has been increased in proportion. Most of them now depend entirely on electricity for watering their flocks and lighting their poultry houses and operating incubators and brooders.

* * *

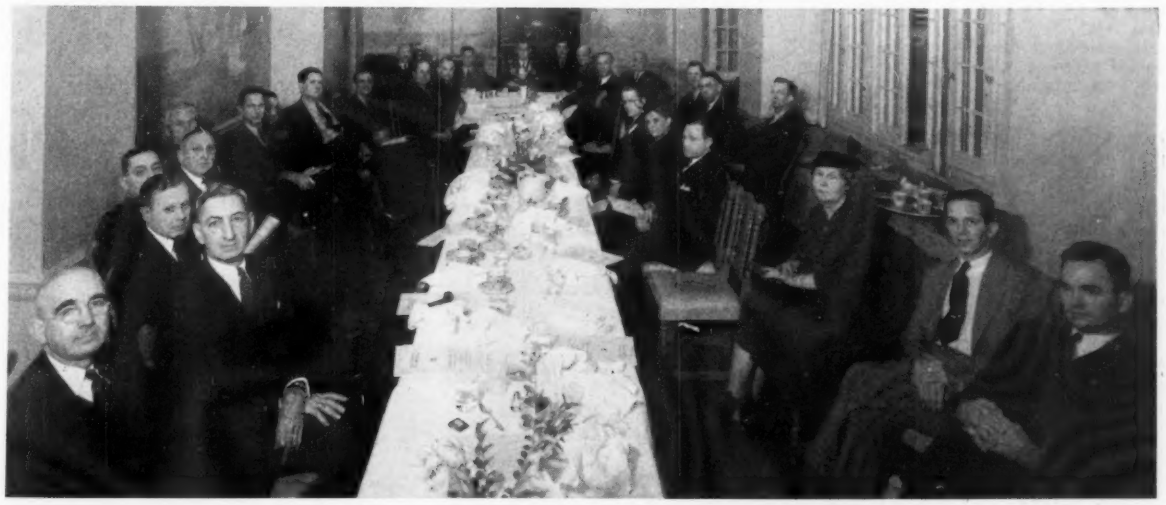
An epidemic of whittling threatened the telephone and power poles in Arkansas, Mississippi and Tennessee until the utilities wrapped their poles with wire for the first seven feet. One rural town reported three telephone poles completely cut down by the town's whittlers, who wielded their pocket knives on the poles during their spare time.

Southern Section, IAEI, Expanding Membership

Continuing the most successful membership campaign initiated last year, which resulted in a net gain of 102 members, the Southern Section, International Association of Electrical Inspectors, has started the current campaign with enthusiasm and has already signed up 18 new members in the first thirty-day period following the annual meeting, according to announcement by C. M. Jones, secretary-treasurer.

The honor roll below indicates the names of members who have been responsible for bringing new members into the organization since October, 1941.

Boger, C. S., Charlotte, N. C.	1
Bommer, A. J., Dallas, Texas	1
Bushnell, R. O., Miami, Fla.	1
Edwards, Steve, Quincy, Fla.	1
Edwards, T. W., Jacksonville, Fla.	1
Fisher, J. G., Jackson, Miss.	4
Hancock, A. E., Austin, Texas	1
Harpster, R. L., West Palm Beach, Fla.	1
Hayes, Day, Corpus Christi, Texas	1
Peeples, Troy, Roby, Texas	1
Welman, Geo., New Orleans, La.	1
Whitaker, C. S., Durham, N. C.	4
TOTAL	18



Southwestern Section, IES, Plans "Area" Meetings

Members of the Southwestern Section, Illuminating Engineering Society, in the Dallas-Fort Worth area, held a dinner and meeting at the Stoneleigh Hotel, Dallas, Texas, on the evening of October 29th. It was the first of a series of local area meetings which have been planned by the Papers and Meetings Committee of the Southwestern Section for 1941-1942.

Two papers were presented, after which there was considerable discussion of these and other subjects, the meeting being conducted as a round-table discussion of matters of interest to the lighting men. The two papers were "Lighting Large Factory Areas With Fluorescent Lamps," presented by A. N. Saxon, of Graybar Electric Co., Dallas, and "The Design of Fluorescent Fixtures," given by E. S. Robison, of Westinghouse Electric Supply Co., Dallas.

The meeting was presided over by R. L. Knapp, illumnating engineer of Dallas Power & Light Co., who is chairman of the Dallas-Fort Worth chapter.

Area meetings, rather than general meetings, are to be held three or four times a year in the Southwestern Section. The Section is divided into six areas, as follows: Houston-Beaumont, Oklahoma City, San Antonio-Austin, Shreveport, Tulsa, and Dallas-Fort Worth.

MANUFACTURERS' News

Mazda F Lamp Conferences Scheduled for 50 Cities

With some fifty key cities on their itineraries, three troupes of Nela Park executives, property men and others "hit the road," early in October, to stage GE Mazda F-lamp "all-out" Conferences from coast to coast. Some of these meetings have drawn attendance numbering more than one thousand electrical contractors, wholesalers, lamp retailers, and utility people.

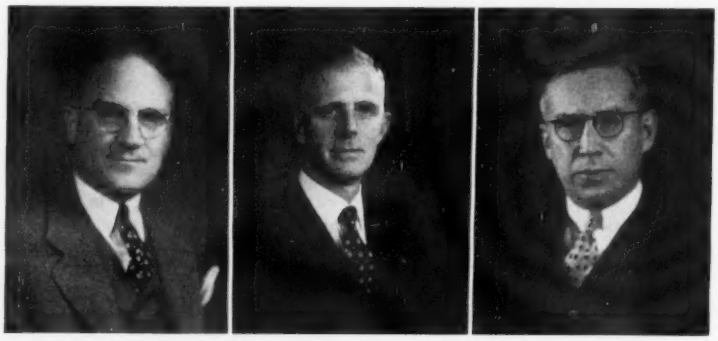
Highlighting the programs — designed to cover every phase of fluorescent lighting for defense industries, for commerce, and the home—are spectacular lighting demonstrations, fluorescent black-light effects, and dramatic skits. Climaxing these features in each case is the crowning of a local "Miss Fluorescent" while she stands before a model of U. S. Army bombing plane aglow with the 74 types and colors of GE Mazda fluorescent lamps.

Host for each of the parleys is one of the 17 sales divisions of the GE lamp department. Presiding at the meetings in the various territories is the regional GE lamp sales division managers.

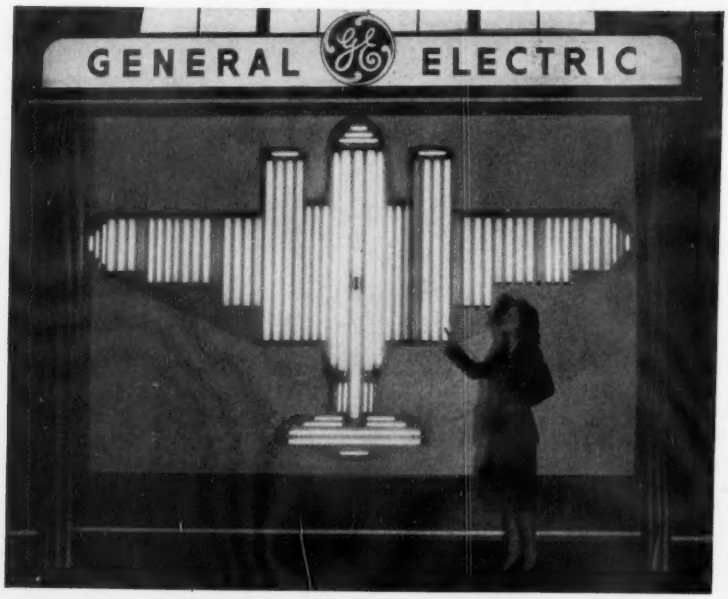
Outstanding speakers of the Eastern Troupe are the following Nela Park authorities: E. E. Potter, eastern general sales manager; H. F. Barnes, sales promotion manager; James Ketch, illuminating engineer; and, Harold Green, in charge of light conditioning promotion. The Central group features these men: N. H. Boynton, general sales manager for GE Lamp Department; Matthew Luckiesh, director of Lighting Research Laboratory; and L. C. Kent, managing director of GE Institute at Nela Park. The Western Troupe is headed by C. O. Brandel, Nela Park sales executive; C. E. Weitz, Nela Park consulting engineer; and, Arthur Loewe, co-ordinator of fluorescent lamp manufacture and the F-lamp fixture makers. Other Nela executives included are: W. C. Brown, E. D. Stryker, and R. P. Burrows.

On each program, the speakers, besides reviewing progress in lighting with special emphasis on the fluorescent lamp angle, reveal how the various divisions in the electrical trade can best go after the lucrative F-lamp renewal business; point out the advantages of GE Mazda F-lamps and Nela Park sales helps; show how to sell F-lighting to stores, offices, factories and to the home — how members of the trade can make their individual places of business "Fluorescent Headquarters" — give the latest facts on F-lamp switches, starters, ballasts, etc.,—and demonstrate the many advantages to be had from getting going now in the matter of selling high-level lighting.

Southern and Southwestern cities included in the itinerary are: Baltimore, Washington, Richmond (Va.), Atlanta, Birmingham, Chattanooga, Charlotte (N. C.), Oklahoma City, and New Orleans.



E. E. Potter W. C. Brown R. P. Burrows



"Miss Fluorescence" stands before the "Wings of Vision for Defense Production" display. The spectacular exhibit contained the 74 different types, sizes, and colors of GE Mazda fluorescent lamps. The design took the form of a U.S. Army bombing plane zooming skyward. With all these lamps lighted, the display convincingly demonstrated the wide assortment of GE Mazda F-lamps at the disposal of the trade and consumer.

Washer Manufacturers Will Make Gun Mounts

Wilbur H. Winters, vice-president of the American Brake Shoe and Foundry Company, New York City, has been engaged by the prime contractors to serve as general coordinator in the handling of the $12,000,000 order for anti-aircraft gun mounts recently granted to the household washer-ironer industry. The prime contractors are the Nineteen Hundred Corporation, St. Joseph, Mich.; Apex Electrical Manufacturing Company, Cleveland, Ohio, and the Easy Washing Machine Corporation, Syracuse, New York.

Announcement of Mr. Winters' appointment was made at a meeting in Chicago of the American Washer and Ironer Manufacturers' Association, attended by seventy representatives of the industry and conducted by W. Neal Gallagher, president of

the organization and head of the Automatic Washer Company, Newton, Iowa.

Production of the gun mounts by the three prime contractors and by the remainder of the companies in the industry acting as sub-contractors will involve the manufacturing of 500 parts and the use of 2,500 special gauges.

An entirely new executive production organization will be set up within the industry for the expeditious handling of the contract, with its members drafted from the staffs of the various prime and sub-contractors.

Hygrade Holds Fluorescent Lighting Conference

The Hygrade Sylvania Corporation, Salem, Mass., were hosts to electrical jobbers and utility lighting men from all over the Southeast at a two-day fluorescent lighting conference in Pinehurst, N. C., November 10 and 11. Indicative, perhaps, of the new commercial and industrial importance of the South was that this show—first Hygrade school or conference to be held away from their plants at Salem and Ipswich, Mass.—was brought to the Southeast. The meeting was distinguished by the Hygrade executives present. Among them were E. J. Poor, chairman of the board; F. J. Healy, vice-president and general manager; C. G. Pyle, sales manager, and Paul Ellison, director of sales promotion and advertising.

Robert M. Rausch, southeastern sales supervisor, served as host for the meeting. In the Monday morning session, William P. Lowell, Jr., of the Hygrade Engineering Department, discussed the remarkably rapid progress of fluorescent lighting and the progress anticipated in the next few years. He stated that in 1938 the industry produced 200,000 fluorescent lamps. The estimated total production for 1941 will be 24,000,000 lamps, and next year the total is expected to reach 40,000,000. Production of 115,000,000 is forecast for 1945. He compared this to a total production of 681,000,000 incandescent lamps in 1941.

Left to right, J. R. Duffy, Hygrade's assistant advertising manager; H. A. Thompson, of Arthur Kudner, Inc., (advertising agency); and Paul Ellison, Hygrade's director of advertising and sales promotion.

Mr. Lowell declared that the fluorescent lamp has given the electrical jobber and dealer an opportunity to get back into the lamp business, and he emphasized that this is a real dollars and cents opportunity, but to capitalize it the electrical jobber and dealer must promote it aggressively, establish themselves in the business and hang on to it.

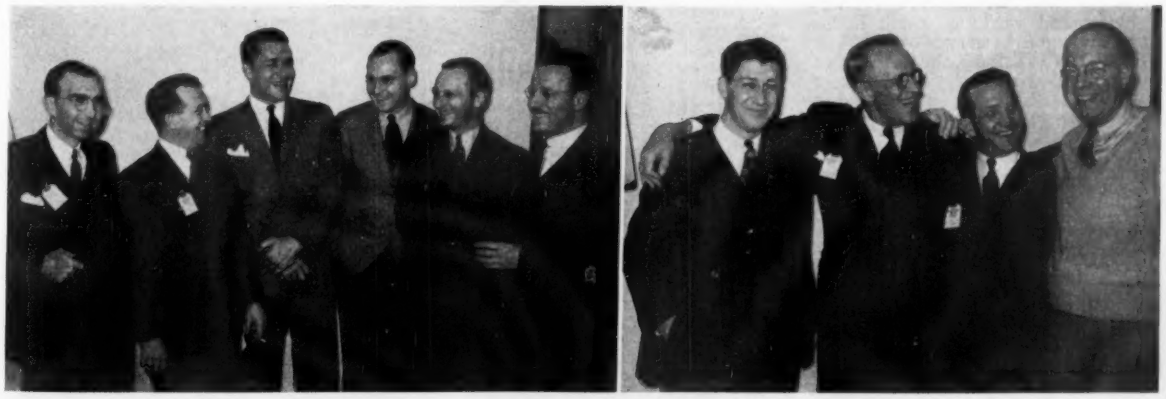
Other discussions at this session were: "Fluorescent Practice," by Harris Reinhardt; "Fluorescent Research Products," by Donald I. Coggins, and "Where Do We Go from Here," by Donald P. Caverly.

Monday afternoon was devoted to a golf tournament, in which prizes were won by Harry L. Gilham, Atlanta, Ga.; W. G. Wood, Raybro Electric Co., Jacksonville, Fla.; Jack Hannum, Fries, Beall & Sharp, Washington, D. C.; Paul Swazey, Virginia Electric and Power Company, Norfolk, Va.; and John Goodwin, Electrical South.

The second day's business program included a talk by William F. Rooney of Hygrade sales department on cold cathode lighting. Mr. Rooney pointed out that some cold cathode tube lighting has been sold for general interior illumination, despite the fact that it is less efficient than the fluorescent tube. For the present, however, he said, it is better suited for decorative or atmosphere lighting, outdoor advertising, etc. The cold cathode tube is not yet a jobber's item, he pointed out, but it should not be forgotten by men in the lighting industry because of its present use as a special purpose lighting tool and because of its probable development within the next few years to a point of more general and widespread application.

"Practical Factors Affecting Fluorescent Circuits," was discussed by Harris Reinhardt, of the engineering department, and "Design Trends in Fluorescent" was the topic of a talk by William P. Lowell, Jr.

Bob Seamans, assistant sales manager, and Jimmy Duffy, assistant advertising manager, were in charge of arrangements and invitations for this constructive and enjoyable conference.



Among those in attendance at Hygrade's Southeastern Fluorescent Lighting Conference, held at Pinehurst, N. C., were: (Left to right) Karl Kramer, Virginia Electric and Power Co., Norfolk; Paul Tysinger, Duke Power Co., Charlotte; Mike Chauncy, Hygrade district representative, Charlotte; Don Caverly, Hygrade commercial engineer, Salem, Mass.; Phillip Peeples, Georgia Power Co., Atlanta; Paul Swazey, Virginia Electric and Power Co., Norfolk; W. B. Shenk, Virginia Public Service Co., Charlottesville; A. C. Bergh, Florida Power and Light Co., Miami; Paul Tysinger, again, of Duke Power Co.; and C. G. Pyle, Hygrade's general sales manager, Salem, Mass.

George C. Thomas Elected President of NEMA

George C. Thomas, Jr., president, The Thomas & Betts Co., Elizabeth, N. J., was elected president of the National Electrical Manufacturers Association at the concluding session of the annual meeting which was held at the Hotel Waldorf-Astoria, New York, October 27-31. Mr. Thomas succeeded Earl O. Shreve, vice-president of the General Electric Co.

George C. Thomas, Jr. (right), president of The Thomas & Betts Co., and newly elected president of the National Electrical Manufacturers Association, receives the gavel from his predecessor, Earl O. Shreve, vice president of the General Electric Co.

In a statement following his election, Mr. Thomas declared that "the defense program is an all-time challenge to the productive capacity and ingenuity of electrical manufacturing companies." Services of our industry, he said, are needed to speed up production in all other industries, and in most businesses and distribution channels.

It is worth noting, Mr. Thomas concluded, that the electrical standard of living and working is a cornerstone of democracy in practice, of democracy in the every-day existence of the great majority of our people. Our industry, through NEMA, welcomes its duty to help defend a way of living and working which it has been privileged to serve.

Problems facing the electrical manufacturing industry in connection with both vastly increased production for defense and maintenance of the best possible levels in the output of electrical goods for general use provided the dominant theme of discussions and meetings during this annual conference.

A highlight of the convention was the annual luncheon, on October 29, at which Mrs. Thomas Alva Edison, widow of the inventor, and James H. McGraw were honored guests. More than 500 NEMA members and guests attended. The manufacturers' medal and purse of the James H. McGraw Award for Electrical Men was presented to Dwight G. Phelps, vice-president, Colt's Patent Fire Arms Manufacturing Co., by Horace P. Liversidge, president, Philadelphia Electric Co., and a member of the Committee of Awards.

Mr. Phelps received the 1941 award in recognition of his "distinguished contribution to the manufacturing branch of the electrical industry in the surveying of wage experience within the industry to establish a sound basis for company policy and for minimum wage control under the Walsh-Healey law."

Five vice-presidents elected at the concluding session on the following day were as follows:

H. E. Blood, president, Norge Division, Borg-Warner Corp., Detroit; Ralph Kelly, vice-president, Westinghouse Electric & Manufacturing Co.; Max McGraw, president, McGraw Electric Co., Chicago; F. W. Magin, president, Square D Co., Milwaukee; W. E. Sprackling, vice-president, Anaconda Wire & Cable Co.

Leonard Kebler, president, Ward-Leonard Electric Co., Mt. Vernon, was re-elected treasurer.

* * *

H. E. Merrill has relinquished his duties as advertising manager of the General Electric construction materials division, Bridgeport, Conn., and has been appointed to the new post of product promotion manager where he will have the immediate responsibility for the sales development of fluorescent devices for both the accessory equipment and the wiring devices sales sections, it has been announced by **T. D. Foster,** manager of accessory equipment sales.

H. E. Merrill

The change has brought about the appointment of **Andrew Doremus** as construction materials advertising manager by **J. H. Crawford,** manager of the Construction Materials Division with the approval of **Boyd W. Bullock,** general advertising manager for the G-E appliance and merchandise department.

Andrew Doremus

Mr. Merrill, a native of Exeter, N. H., and a 1927 graduate of Bowdoin, joined General Electric at Bridgeport in 1930, joining the advertising production section the following year and later transferring to construction materials advertising. He became manager of the latter activity in 1937. For the past year he has been vice-president of the Industrial Advertising and Marketing Council.

Mr. Doremus, a native of Clifton, N. J., became associated with G-E construction materials advertising in 1934, following his graduation from Syracuse.

* * *

The Youngstown Steel Products Co., recently announced the appointment of **P. G. Boyd** as district sales manager of the newly established Washington district, which includes the District of Columbia, the northeastern section of North Carolina, all of Virginia except Bristol. This territory was formerly part of the Philadelphia district. The Washington, D. C., office is located at 820 Shoreham Building.

* * *

BullDog Electric Products Co. announces the appointment of **Herbert H. Benefield** as New York district manager. Well known to electrical wholesalers, contractors and industrial engineers, as the former sales manager of Steel Tubes Division of Republic Steel Company, Mr. Benefield is one of the aggressive young sales executives who was eminently successful in promoting the original use, application and marketing of thin wall conduit.

H. H. Benefield

Following his initial sales training and work in the East, Mr. Benefield spent a number of years on the West Coast and was subsequently appointed executive sales head of Steel Tubes Division, in which capacity he has been engaged for the past several years. He assumed the duties of his new position early in December.

* * *

J. F. O'Brien, president, Pierce Laboratory, Inc., 40 West 40th St., New York, manufacturers of Pierceway plastic surface wiring systems, announces the following staff ap-

CONTRACTORS *WHO USE* AND ARCHITECTS *WHO SPECIFY*

ILLINOIS PORCELAIN

★ *can guarantee completely insulated wiring systems*

★ *can establish themselves securely with their customers*

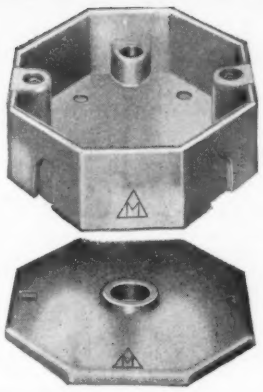
★ *can make each job a quality one*

★ *can build up business and increase profits*

★ *can meet every requirement most modernly*

★ *can guarantee every wiring device carries the Underwriters' Laboratories label*

Here is the opportunity for Architects to specify and Contractors to install completely insulated wiring systems of porcelain, which are safe, economical, efficient, and easy to install. Illinois Porcelain has made this system available for residential and farm wiring where permanency and utmost safety are of prime importance. In addition, they are especially suited for industrial installations, warehouses, cold storage and packing plants, dairies, chemical works, ice plants, breweries, or any place where dampness and fire hazards are prevalent. The use of this system renders grounding unnecessary and makes possible a safe and economical wiring system that lasts indefinitely.



OUTLET BOXES

Glazed and unglazed styles conforming to all existing standards of dimensions, spacing, position of knockout holes, and mounting screws. High mechanical and electrical efficiency.

STANDARD TUBES

In sizes ½ to 48 inches long, 5/16 to 3 inch diameter in following types: unglazed, glazed, split, floor, split floor, headless, curved end, crossover split, and crossover. Diameters all uniform both inside and outside.

SWITCH BOXES

Insure greater safety in wiring and the elimination of all grounding hazards. Made of best quality white porcelain. Metal inserts are placed in two holes of the switch boxes for receiving screws of standard switches, plug outlets, etc. Knockouts for single wires, also for cables. Specify and use them.

KNOBS

Cement coated—nail — genuine leather washer — code standard. They don't chip when driven in and they do stay in place and have a firm grip.

CENTRAL LOCATION INSURES QUICK DELIVERY anywhere in U.S.

Profit by using
ILLINOIS As Your Source of Supply

Standardize on

ILLINOIS PORCELAIN

TOP QUALITY - - - EXACT DIMENSIONS

ILLINOIS ELECTRIC PORCELAIN CO. **MACOMB, ILLINOIS**

You wouldn't make a gas connection with a set screw connector. An electrical connection is just as important.

Stop those current losses with a connection that grips the cable like a Gorilla. The principle of the nut and wedge are used for a maximum compression. Dependable locking action in every connector. Pressure is uniformly distributed over full contact area.

A "Gorilla Grip" Connector requires no special tools and may be used over and over again without loss of efficiency. Investigate, write for descriptive literature.

National Electric
PRODUCTS CORPORATION
300 FULTON BUILDING, PITTSBURGH, PA.

pointments effective immediately:

V. A. Gwyer, vice-president, was formerly vice-president of Reynolds Metals Company and until recently, New York manager of Hartford-Empire Company.

C. A. Norton, sales manager, was associated with the Westinghouse Lamp Company for many years. He is a member of the Board of Governors of the Electrical & Gas Association of New York and has been active in the electrical industry for over thirty years.

H. J. Morton, sales promotion manager, before joining Pierce Laboratory, was associated with the Detroit Edison Company as engineer on wiring codes and standards. More recently, he was technical advisor and sales promotion supervisor of wiring development for the Edison Electric Institute and the Association of Edison Illuminating Companies.

J. W. Parr, comptroller, was formerly associated with the Bank of Manhattan Company.

E. S. Boynton, manager of engineering, has spent many years in engineering and manufacturing, having been connected with Remington Arms Co., International Business Machines, Remington Typewriter, Slocum Avram and Slocum Laboratories, and Lehigh Corporation.

These men will be located at the plant at Summit, New Jersey.

* * *

The appointment of **R. F. Orth** as manager of Johns-Manville's Public Utility and Electrical Department was announced this week by **T. K. Mial,** J-M vice-president in charge of industrial sales.

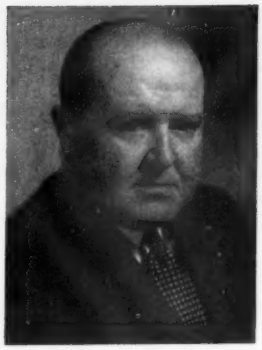
After being graduated from Texas A. & M. College in 1923, Mr. Orth was employed by the Western Electric

R. F. Orth

Company. In 1924 he joined the Johns-Manville organization, and since that time has served in various capacities. In 1940 he was made staff manager for J-M Transite Pipe sales in the West with headquarters at St. Louis, a position which he held until his recent move to New York to take over his present duties.

* * *

Jesse H. Lide has been appointed assistant general advertising manager of the Westinghouse Electric and Manufacturing Company, **G. E. Pendray,** assistant to the president, has announced. His headquarters will be



J. H. Lide

in the company's Pittsburgh office.

Since September, 1940, Mr. Lide has been assistant advertising manager of the Westinghouse merchandising division in Mansfield, Ohio.

Born in Corinth, Miss., on September 27, 1902, Mr. Lide attended Mississippi State College. He joined Westinghuose in 1924 following his graduation. After a year in the company's publicity department in East Pittsburgh, Mr. Lide joined the advertising section in Mansfield. He entered the company's sales promotion department in 1926 in the Atlanta, Ga., office.

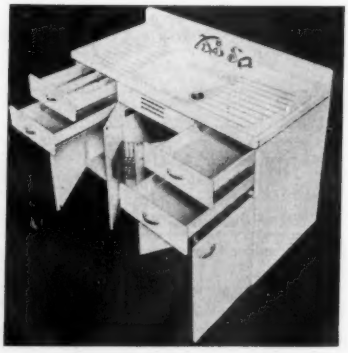
Mr. Lide left the company in 1929 to become advertising manager of the Rome Wire Company in Rome, N. Y., and later general advertising manager of the General Cable Corporation. He joined Westinghouse in 1931.

New Products

Hotpoint Cabinet Sink

Hotpoint has revised its line of Standard Steel Kitchen Cabinets to include two new Hotpoint Steel Cabinet Sinks. The total number of models in the Hotpoint Standard Steel Cabinet line has been reduced to facilitate production of popular models.

The new Hotpoint Steel Cabinet Sinks are available with two or four drawers. Both have three storage cabinets. They have grooved, double drainboards, with soap dish and level deck at the back for goblets. Other convenience features include a utility



NO. 9

ALUMINUM, DEFENSE, AND YOU

ALCOA

SIX MORE PLANTS IN FIVE STATES ON THE WAY

DEFENSE PLANT CORPORATION OWNS THEM. We've been designated to build them . . . fast.

Actually, when the names went on the dotted lines of the contract on August 19, we had already placed more than $16,000,000 worth of orders for some of the equipment and materials it takes longest to make and get.

FIVE OF THESE PLANTS will smelt aluminum. Their combined capacity is planned for more than 500,000,000 pounds a year, which is greater than the nation's entire production of aluminum in 1940. Locations: Massena, N. Y., Spokane, Wash., Troutdale, Ore., Los Angeles, and in the State of Arkansas.

The sixth plant will refine alumina from bauxite. Its billion-pounds-a-year capacity adds 58% to the nation's alumina capacity. It will be located at Bauxite, Arkansas.

HOW GOES CONSTRUCTION? At this writing, as fast as title is secured to the sites, contracts are being let for grading and foundations so as to be ready for the structural steel, which is coming as rapidly as it can be gotten.

What is more important, the aluminum plants are scheduled to deliver ingot by the summer of 1942; the refining plant to deliver alumina in early summer, 1942.

WE'VE ASSIGNED a large staff of men full time to headquarters engineering, purchasing, and accounting on this government building job.

We're sending competent and experienced management men out on these jobs as superintendents and other staff executives on construction, and for subsequent operation of such of these plants as we are designated to operate.

EVERY KNOWN IMPROVEMENT in design and construction and equipment is being incorporated in these plants. We intend that every dollar that will be spent shall be the best dollar's worth that experience can build. We do not make one cent of profit from this assigned job of construction.

We think we know how to get the government value-received for its money, because we are completing the expenditure of more than $200,000,000 of our own money in an expansion program which started after the beginning of the present war. Some of this expenditure is in new alumina and aluminum plants which will bring our own Alcoa capacity up to more than 700,000,000 pounds a year. The remainder is in tremendous expansion of facilities for fabricating every form of aluminum.

DEFENSE, GENTLEMEN, is getting its aluminum.

ALUMINUM COMPANY OF AMERICA

basket, hung on the left front door and a linoleum-lined cutlery drawer. Altogether, each sink has 22 cu. ft. of cabinet storage space.

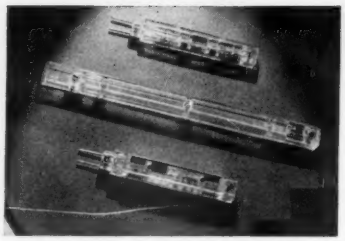
Heavily coated in stain- and acid-resisting porcelain enamel, the new Hotpoint Steel Cabinet Sinks are 54 in. long and 25 in. deep, with 36 in. work surface height, and 4-inch panelled back splash. Bowls are 7 in. deep, with 3½-inch drain openings, to accommodate installation of the famous Hotpoint Disposall, when desired. Sink decks are drilled for installation of the most modern ledge-mounted faucets with spray attachment. These are not furnished with the sinks.

* * *

Plastic Surface Wiring System

A basic contribution to progress in the field of electrical wiring was recognized by a top award in the Architecture Classification of the Sixth Annual Modern Plastics Competition to Pierce Laboratory, Inc., Summit, New Jersey, for its Pierceway Residential and Industrial Type Surface Wiring System, using plastic as its basic material. This new development is the result of extensive research and experimentation to develop an economical wiring system that provides more adequate outlets at a cost commensurate with conventional installations.

Based on the fact that electricity can be more efficiently distributed, with less copper, when the conductors are in bare, rather than insulated form, this product makes use of thermo-setting plastic housings in a surface wiring system. The plastic materials used are furnished by the Bakelite Corporation.



The wiring system employs only two basic materials: metal for conducting the current, and non-current conductive plastic housings. This method effects a saving of essential materials such as steel, zinc, brass, rubber, etc., which are necessary in conventional wiring systems.

Among the advantages claimed for this new system are: ample capacity, electrically non-conductive plastic housings, adequate mechanical protection, lower initial installation cost, rapid assembly or installation, simple disassembly and reassembly, and equivalent electrical facilities with a substantial reduction in the volume of essential materials used.

The residential system is smaller in dimensions than the industrial type, has No. 12 copper conductors and provides 30 ampere capacity with duplex outlets at 12 inch intervals. The Industrial type employs tubular copper conductors and provides 45 ampere capacity wtih outlets at 8 inch intervals.

* * *

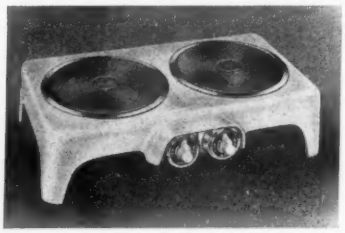
Premier Service Promotion

Premier's recently introduced program for helping dealers promote vacuum cleaner service is fully described in the new broadside, "What's Ahead?" In addition to outlining the many advantages of greater emphasis on servicing cleaners already in use, the colorful broadside illustrates and describes the promotional aids Premier has prepared — brush, belt and reconditioning display cards, window transfers, illustrated direct-mail cards, booklet on moth control and stain removal and many other helpful items.

* * *

"Short-Order" Hot Plates

Equipped with economical, efficient Chromalox Heatflo units. These units consist of a special alloy casting with nickel chromium coils embedded in refractory in channels on under side of plate. They are durable, will not warp, easy to keep clean and provide even distribution of heat with flexibility of performance. Frame is of heavy, serviceable cast iron, with sanitary white porcelain finish.

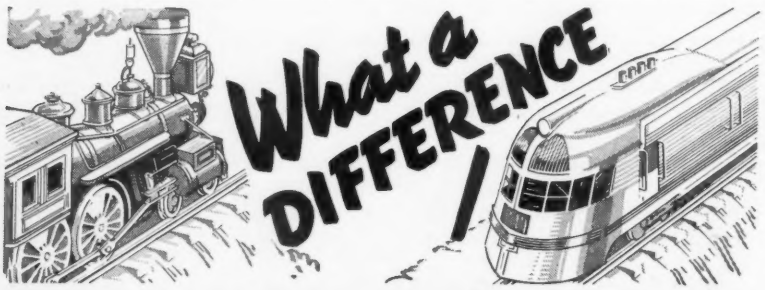


Ideal for diet kitchens, cafeterias, domestic service departments, grills and laboratory use, etc., these hot plates are supplied with 1200 or 2000 watt units in single (SHB) or double (THB) frame with switch for 3-heat operation on 115 or 230 volts.

* * *

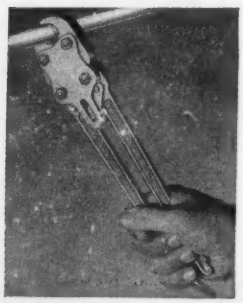
High Voltage Transformers

Core and coil construction of Allis-Chalmers circulator coil, shell type high voltage power transformers are fully described in a new 20-page bulletin, B6171, just released by the Allis-Chalmers Mfg. Company, Milwaukee, Wisconsin. The unusually thorough description is featured with a cut-away section through a typical transformer, showing construction.



And there's just as much difference between the *streamlined* BRIEGEL METHOD of making connections and former old-fashioned methods.

The BRIEGEL METHOD saves you up to 50% on time and a substantial saving on materials allowing you a larger margin of profit on each job. Make quick, easy, strong and neat connections this MODERN way.



No extra turns or twists, no nuts to tighten when you use B-M connectors and couplings. Just TWO SQUEEZES with the patented B-M indenter (which costs you only $1.25) and you have a smooth efficient job. Approved by Underwriters Laboratories.

DISTRIBUTED BY

The M. B. Austin Co. Chicago, Ill.
Clayton Mark & Co. Evanston, Ill.
Clifton Conduit Co. Jersey City, N. J.
General Electric Co. Bridgeport, Conn.
The Steelduct Co. Youngstown, Ohio
Enameled Metals Pittsburgh, Pa.
National Enameling & Mfg. Co. Pittsburgh, Pa.
Triangle Conduit & Cable Co. Elmhurst, N. Y. C.

BRIEGEL METHOD TOOL CO., Galva, Ill.

FOR SALE

1 - 40 H.P. 685 RPM 220 V 3 P - 60 Cy Willey slip ring motor with pulley, Allis-Chalmers drum controller and resistor.

1 - 40 H.P. 680 RPM 220 V 3 P 60 Cy Willey squirrel cage motor with pulley and GE compensator.

This equipment in good operating condition. Write Theobald Electric Supply Company, 113 So. 8th St., Louisville, Ky.

Plant Distribution Systems

For use in industrial plants and power stations, radial and secondary network distribution systems are described in a 77-page book announced by Westinghouse Electric and Manufacturing Company.

Covering everything from substations and switchgear to small auxiliary equipment, the book is probably the most comprehensive of any yet published on this subject.

Divided into four parts, the scope of the book is as follows:

1. Radial Systems:
   (a) With single transformer substation.
   (b) With radial primary feeders
   (c) With loop primary feeders
2. Banked transformer system
3. Plant network systems
4. Associated electrical apparatus
   (a) Switchgear — metal-clad and low voltage metal enclosed
   (b) Unit substations—multiple and single feeder
   (c) Distribution transformers—air, oil and Inerteen, Unit power and lighting centers.
   (d) Limiter boxes, panel boards, and bus ducts

In all cases typical applications and specifications for standardized units of equipment are described in detail.

Motor Starting on Network Systems

(*Continued from page* 23)

where a point can be saved.

A blower is similar in speed-torque characteristics to a pump with the exception that there is more inertia. The inertia can be very appreciable on some blowers or exhaust fans and higher accelerating torques are desirable to get up to speed more quickly. The only positive rule that can be stated is that for high torque starting where the locked rotor current is simply divided by the increment value to obtain the number of points starting. To simplify all applications and to avoid misunderstanding, it would appear desirable to all parties concerned that all jobs be calculated on this basis. The majority of the applications will fall in the two-point class where there is no saving between low and high torque starting. Of course, all of this is with reference to the squirrel cage induction motor.

Figure 3 shows a typical increment start, two point, with line contactor and one resistance contactor and timing relay. The resistance is mounted on the back of the panel. Additional points simply require additional resistance contactors and timing relays.

Synchronous motors are for the most part started as squirrel cage motors, utilizing a cage construction on their field poles, and the field is energized only after the motor is brought up to speed and across the line as a squirrel cage motor. However, in closing the field, an inrush of current is involved, the amount depending on the position of the field poles at the instant of closing the field circuit. If the field poles were exactly in step, there would be no disturbance. But if the motor had to slip a pole to get into step, the disturbance would be appreciable, and may require phase angle synchronizing. All synchronous motor applications should be given special consideration.

Slip Ring Motors

The slip ring motors give higher torque per ampere on starting than any other type of induction motor. The combined cost of the motor and its control is much more expensive than squirrel cage motors. For metropolitan areas they are used in special cases, and for special purposes. The control of a slip ring motor is inherently an increment starter and easily adaptable to network requirements. However, the starting characteristics are entirely different from squirrel cage motors and each application should be referred to the supplier.

Insofar as the starting of squirrel cage motors on network systems is concerned, the foregoing considerations indicate that the problem of application would be greatly simplified if each case were figured on the basis of dividing the locked rotor current by the increment value to determine the number of points required for starting. This practice would eliminate misunderstandings and would clarify the use of this equipment on all installations.

Emergency Conditions Occupy Utility Conference

(*Continued from page* 21)

simply stagger the imagination. This type is harmful to the eyes but it can be put in air-ducts where it can always be concealed from the eyes," Mr. Sturrock said.

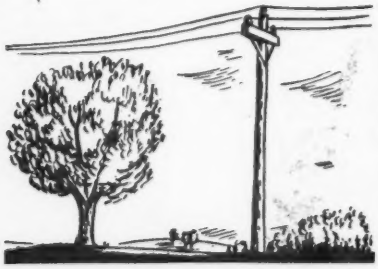
The speaker illustrated, with the aid of many pieces of equip-

PLACE ONE LAMP TERMINAL IN SLOT — TWIST — CLICK — IT'S LOCKED
Pats. Pend.
PAT PEND
STRONG AS AN OX
Lloyd amazing, new plastic compound guarantees against costly breakage. Contact and lock are positive. No strain on pins or casing. Tempered steel spring more than doubles strength of lock.
LLOYD PRODUCTS CO., Box C, Edgewood Sta., Prov., R. I.
Representatives in 22 Leading Cities
Black — Cat. 351
Black Combination with Starter Socket Cat. 353
White — Cat. 351-W
White Combination with Starter Socket Cat. 353-W

At the "End of the Line"

Men are at work—millions of them—at the "end" of every power line. The great majority of them are on jobs vital to our defense—work that must not be interrupted by power failures. . . . You can avoid a frequent source of outage by putting it up to Asplundh to keep your lines always free and clear of tree trouble. . . . One of our several different contracts is sure to meet your requirements and budget.

Write for them today



ASPLUNDH
TREE EXPERT COMPANY
Jenkintown, Pennsylvania
Ogontz 3750

Chicago, Ill.	Baltimore, Md.
Binghamton, N. Y.	Durham, N. C.
Columbus, Ohio	Rutherford, N. J.
Cambridge, Mass.	New Castle, Pa.
Alexandria, Va.	Pittsburgh, Pa.
Washington, D. C.	Omaha, Nebr.

Tulsa, Okla.

ment, the difference between fluorescent and phosphorescent illumination and the underlying principles of fluorescent lamps. He also displayed fluorescent lamps of many sizes up to 500 watts. Production of 1,000-watt fluorescent lamps, at this time, is impractical, he asserted, because they would be about 20 feet long and from eight to nine inches in diameter, making them cumbersome.

Utilities Need No Prodding

"The utility industry is doing its job and needs no prodding from the federal government," declared S. W. Williams, editor of *Electrical World*, New York, N. Y., in discussing the subject, "What's Ahead," at both conferences. He referred to huge appropriations, much of which will be used by the federal government in competition with privately owned electric utilities, but cited instances where people of certain sections had put a curb on voting bonds to aid government operation of utility plants, thus expressing a fear of possible federal domination of private industry.

While rationing of electricity has been enforced in some sections, where hydro-electric production has been reduced by droughts, the speaker expressed the belief that the electric utility industry is well prepared to meet the present emergency. The industry now has from 30 days to three months reserves of fuel. It is adding four million kilowatts of generating capacity this year and will add from three to four million kilowatts next year, the speaker estimated. The OPM has predicted that by the end of 1942 the peak demand for electricity for defense purposes will be reached.

"If this be true, by the end of 1943 we may have a surplus of kilowatt producing capacity in the United States," Mr. Williams said.

Speaking at both conferences, J. C. Happenny, Sand Springs, Oklahoma, chairman of the Electric Light and Power Division, of the Oklahoma Utilities Association, expressed faith that the electrical industry will come through the present emergency in good shape, despite high production costs and increased taxes. "Although we have the largest gross income in our history, there remains less money for our stockholders," Mr. Happenny said.

W. H. Carson, dean of the College of Engineering, University of Oklahoma, in his address of welcome to the Western District conference, commended the utilities on the reliability of the industrial survey they made last summer for the Office of Production Management. Dean Carson, in addition to his duties at the University, has been manager of the defense contracts department of the Oklahoma OPM headquarters.

At the Eastern District conference, W. R. Wolfe, Oklahoma Gas and Electric Company, Muskogee, was elected district chairman to succeed T. E. Mansfield, Sand Springs. M. M. Schene, Public Service Company of Oklahoma, McAlester, was elected Eastern District secretary.

New officers chosen to serve the Western District for the ensuing year are: L. A. Wiedman, Oklahoma Gas and Electric Company, Norman, district chairman, to succeed A. P. Burns, Duncan; and Ray Rice, Southwestern Light and Power Company, Elk City, district secretary.

Resolutions, adopted unanimously at the Western District conference and read by E. G. Green, chairman of the resolutions committee, pledged the electric industry of Oklahoma to full cooperation with the national defense program.

Separate Display Facilities Boost Trade-In Sales

(*Continued from page* 17)

trically-operated paint-sprayer. It also partitioned off with canvas a part of its work space for use as a paint shop. Here, traded ice boxes are refinished at an average cost of $1.50, which covers labor and material. General handling expense figures around $3.

When ready for sale, these ice refrigerators look like new, and sell for $15 to $20. The net averages only about $5 but it is *profit—not loss.*

Both advertising and direct selling effort are employed to market used appliances. The company carries a two-line "ad" in the classified sections of local newspapers. *These advertisements are changed daily.*

This day-to-day change stems from simple buyer-psychology. A reader seeing the advertisement repeatedly would be quite apt to say to himself, "Humpf, they still are trying to peddle that old refrigerator. There must be something wrong with it."

INSTANTANEOUS
Electric
HEATERS

HOT or COLD WATER from the SAME FAUCET—when you want it.

• • • The Instantaneous Electric Water Heater is not a portable lamp socket device, but—as shown—is a compact, self-contained apparatus (10½x4¼ inches). Quickly and inexpensively installed. Operates on AC.

Approved by Underwriters Laboratories, Inc.

DISTRIBUTORS WANTED

Mfg. By THE ELECTRIC HEATER COMPANY
BRIDGEPORT, CONNECTICUT, U. S. A.

THIS FELLOW IS

TOUGH

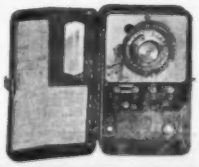
SO ARE

Paragon

300 SERIES

TIME SWITCHES

YES . . . Paragon 300 Series Time Switches are tough, rugged and durable. That's due to several features of design and manufacture, for instance; (1) Only two exposed gears; absolutely dust proof. (2) Operated by slow speed, synchronous motor. (3) Guaranteed for 20° below zero. (4) 2,000% more dial power than necessary. (5) Other advanced engineering features. (6) Approved by Underwriters. Only $13.00 list. Many other types available.



PARAGON ELECTRIC COMPANY
409 So. Dearborn Street, Chicago, Illinois

Southern Representatives

William E. Hopper
357 Marietta St., N.W.
Atlanta, Georgia

George E. Anderson Co.
Santa Fe Building
Dallas, Texas

Large Stocks for Immediate Shipment in Atlanta and Dallas

Paragon Chicago

BUILDERS OF CONTROL INSTRUMENTS SINCE 1905

FLUORESCENT LIGHTING FIXTURES

All Types on Hand for Immediate Shipment.
Economically Priced. Quality Second to None.
Write for latest catalogue and prices.

SOUTHERN MANUFACTURING COMPANY
ORLANDO, FLORIDA

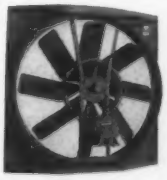
Don't Let Us Just **WISH** You A Prosperous New Year!

Let Us Help You **MAKE** It One with "AUTOMATIC"
TIME SWITCHES
INTERVAL TIMERS
FLASHERS

Write for Information

AUTOMATIC ELECTRIC MFG. CO., Mankato, Minn.

"MORE SPEED"
Cries Industry
"INSTALL COOLAIR"
Is Your Profitable Answer



Defense industry has made proper ventilation a necessity in high-speed production. Factory managers everywhere are turning to Coolair's Breeze-conditioning for greater employee efficiency — faster production in Winter as well as Summer! There's a demand for Coolair Industrial Exhaust Fans. Step right in now—join other alert Coolair dealers all over the country who are enjoying these new all-year profits. Write for free catalogues today.

Coolair Ventilating and Cooling Systems

AMERICAN COOLAIR CORPORATION
Manufacturers . . . . JACKSONVILLE, FLORIDA

GREENLEE BENDERS

FOR ANY OF YOUR BENDING JOBS

Here are just three of the complete line of Greenlee Benders for any size conduit, pipe, or tubing from ¼ to 4½ inches. Small hand benders will handle all tubing up to 3/4-inch, while powerful hydraulic benders will take care of conduit and pipe up to 4½ inches. Write for S-116 Bender Booklet describing complete line of benders and attachments.

Greenlee TOOL CO.

1707 Columbia Avenue
ROCKFORD, ILLINOIS

The change method serves, also, to stimulate action on the part of the procrastinating buyer. When an advertisement fails to appear a second time, the prospective purchaser feels that he may have missed a good opportunity because he neglected to act promptly. After one or two such occurences, he usually decides that he must do his buying quickly or not at all.

Any of Dade's used appliances is partly sold as soon as the customer sees its. And the employment of a separate display room for re-conditioned merchandise eliminates its competition with current models.

The company's franchise includes the entire county in which it is located. Six salesmen work intensively in this territory of more than 50 square miles, a considerable part of which is composed of suburban and rural communities.

During their canvass, salesmen constantly are on the alert for used, as well as new, appliance prospects. The outlying sections, by the way, pay good dividends in the way of sales on both new equipment and on re-conditioned trade-ins.

The firm realizes thoroughly that the purchaser of a used appliance sacrifices for "price" not only the improvements built into current models but pride-of-ownership as well. It therefore watches closely for any signs of betterment in the buyer's financial condition, making it possible for him to buy what he really wanted in the first place.

The Dade Home Appliance Company was established three years ago. Its principals are Dr. Aurelio Perez, president, and his sister, Miss Jennie Perez, secretary-treasurer. Miss Perez acts as office manager.

Mr. Simmons is well-known in the electrical appliance field. For a number of years he was connected in various capacities with the Frigidaire Division of General Motors.

The firm features Frigidaire refrigerators and ranges. Last year its volume on these ran approximately 600 and 200, respectively. Present indications point to a healthy increase for 1941.

In order to expand its field of effort, the company recently added to the line mentioned three types of laundry equipment: Bendix and Maytag washers and Ironrite ironers.

Business Security from Better Management

(*Continued from page* 12)

The estimated margin percentage is 35 so build up the "estimated" column under margin by multiplying monthly sales by this percentage. Get estimated cost of sales by multiplying monthly sales by 65 per cent and estimated net profit by multiplying by 5 per cent. You may insert a "%" column beside each column showing actual results to highlight estimated versus actual percentages monthly. Use red figures for estimates, black for actual results.

The budget is not a cure-all of your business ills nor will it guarantee profits but it provides a definite plan of action that is essential to sound management. Once prepared, it must be checked consistently.

This close attention to the planned movement of your business is worth while even though large discrepancies between estimates and actual results are not disclosed. A

FREE... 24 pages of essential market data

Never before, in one pocket-size book, so much up-to-date, helpful market data on St. Louis. Gives you actual comparisons between St. Louis and other principal markets with which you are familiar.

Twenty-four pages, packed with vital information on retail, wholesale and manufacturing businesses. A must for anyone selling St. Louis.

Write on your business letterhead for your free copy today. Address: Hotel Mayfair, 844 St. Charles St., St. Louis, Mo.

P.S. You'll really enjoy a stop at Hotel Mayfair. Nationally famous for friendly, efficient hospitality, good food and real comfort. And downtown St. Louis is right at your doorstep!

Over 50% of rooms, $3.50 or less, single; $5.00 or less, double.

hotel **Mayfair** St. Louis

There's profit in replacements with

CHROMALOX RANGE UNITS

Fit any electric range in one service call, from a small stock of these units. Low inventory, quick servicing, gratified customers. It means greater profits for you. Write for the full story.

ATLANTA, Ga.–C. B. Rogers, 1000 Peachtree St. DALLAS, Texas–L. R. Ward, 403 Southland Bldg. Annex. RALEIGH, N. C.–W. R. Phillips.

EDWIN L. WIEGAND CO., 7600 Thomas Blvd., Pittsburgh, Pa.

C. B. ROGERS

ELECTRICAL HEATING ENGINEER
CHROMALOX
ELECTRICAL HEATING UNITS
and
CHROMALOX
EQUIPPED PRODUCTS

1000 PEACHTREE STREET
ATLANTA, GEORGIA

THE SALES PRICE

of an article is often from two to ten times its cost to manufacture.

That one fact indicates the opportunities to increase sales and profits through better distribution and merchandising.

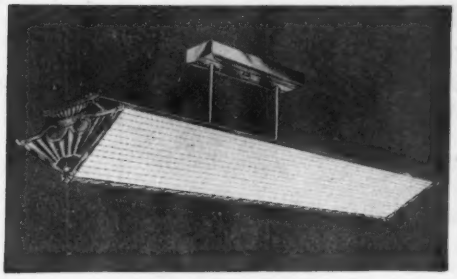
ELECTRICAL SOUTH, through its editorial pages, points the way along constructive lines and presents information, ideas, and plans based on the intimate contact of its editorial staff with the electrical utilities, dealers, and contractors of the South. Coming issues will contain many important merchandising articles relating to sales training, demonstrations, canvassing, appliance servicing, and displays; engineering features describing modern trends in transmission, distribution, and utilization; and many items of special interest to electrical contractors on both practical and technical subjects.

Take advantage of these valuable articles by reading your copy of ELECTRICAL SOUTH carefully each month. If you are not already a subscriber, it costs only $1.00 for one year or $2.00 for three years.

ELECTRICAL SOUTH
GRANT BUILDING ATLANTA, GA.

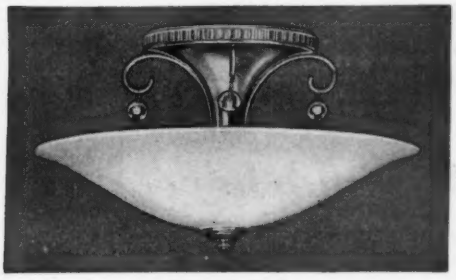
For Smart Fixtures that are the Ultimate in Efficiency See the latest - GLOBE Lines

***For Commercial and Industrial Use . . .*



NEW GLOBE FLUROLUME models . . . High in Quality and Efficiency . . . Moderate in Price.

***New TEE Line Models for Residential Use . . .*



These new fixtures represent the last word in incandescent lighting for the home.

Send for these three New Catalogs:

1. Residential Fluorescent. 2. Residential Incandescent 3. Commercial Fluorescent . . . No Obligation

Representatives for GLOBE in the South:
Mr. Henri Duizend, 2811 Dublin, New Orleans, La.
Anderson-Shattuck, 3117 University Blvd., Dallas, Tex.
Mr. S. M. Wittenberg, 531 Santee Ave., Columbia, S. C.

When in New York - Visit the New Globe Showrooms*

* WHOLESALE ONLY

At 16 East 40th Street,
(Just East of Fifth Avenue)

GLOBE
LIGHTING FIXTURE MFG. CO
Factory Brooklyn, N. Y.

FORGED-IN STRENGTH

BURNDY SERVIT

BURNDY ENGINEERING CO., INC.

ATLANTA, GA.....W. R. Calverly
TAMPA, FLA.....Pat Baldwin, Inc.
SUMMERVILLE, S. C.....J. P. Voight
NEW ORLEANS, LA.....Electron Eng. Co., Inc

budget sets one to thinking about expenses and other business vitals, which, in itself, is helpful. A budget puts a straight jacket on overhead so that expenses do not get out of control, a mighty important factor today because taxes, wages and the cost of doing business in general are climbing fast and must be kept under rigid control if the contractor is to survive.

Network Distribution For Industrial Plants

(*Continued from page* 8)

an increased content of labor, wire, cable, and conduit with usually a decreased cost to the owner.

Applicable to 1200 kva Plant

Naturally, network systems are not applicable to every type of plant. They are, however, particularly suited to the large majority of new plants being built today. Generally speaking, you will find that a network system should be given serious consideration in any plant with 1200 kva of connected load, two sources of incoming power, and load density of from 10 to 15 volt amperes per square foot of floor space.

Application data and engineering assistance is available from the manufacturers, and I am sure that they will be only too glad to help you. There are many variations of the system discussed here which for obvious reasons we haven't attempted to describe but from what has been presented it is obvious that the industrial network system is a real opportunity for contractors in the defense program.

Wire Simplification Aids National Defense

(*Continued from page* 10)

Types RP and RH would be eliminated. This would return the Code to the fundamental principle of a sound minimum safety standard, since, as indicated before, returning to the 1937 current carrying capacity table would result in extinction of Types RP and RH. Through universal adoption of the second step, we would maintain the fundamental principle of the Code as a minimum safety standard, and still, at the same time, permit the Code to reflect progress in the art of wire manufacture through invention. Adopting the third step suggested above would further support both the fundamental principles. Through gradual change none of the commercial interests involved would suffer.

In considering the above, it should be remembered that some relief should be afforded the industry during the emergency. Existing standards should not be withdrawn immediately. Temporarily they may be set aside and the use of the new Type R wire should be accepted. The use of additional wires should be provided for as they become available in the interest of saving materials.

If we find the answers, we can benefit our industry during the emergency and at the same time act in the patriotic service of our country. If we fail to meet these problems promptly, we not only face the possibility of outside interference in regulating our industry, but we may face the loss of our present electrical standards as well.

It is a time for intelligent, courageous action without the lowering of present standards!

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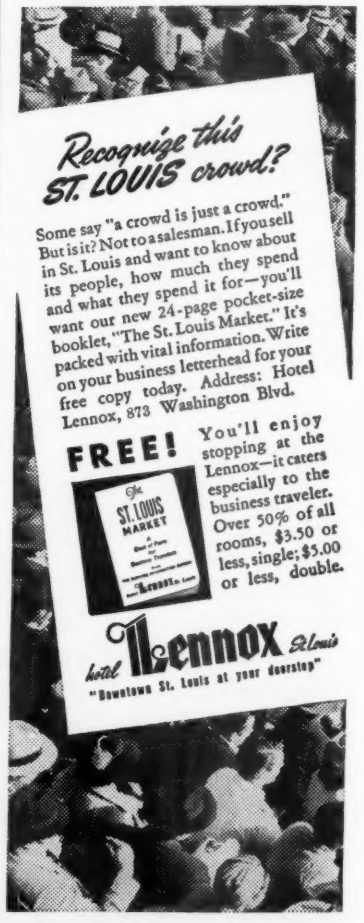
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114. IDEAL PRODUCTS CATALOG — A special 25th anniversary catalog has just been issued describing the complete line of Ideal Products. Electrical Contractors, Motor Rewinders, and Industrial Maintenance Electricians will be particularly interested in this comprehensive publication. Ideal Commutator Dresser Co., 1270 Park Avenue, Sycamore, Ill.

115. FLUORESCENT LIGHTING ACCESSORIES—Fall Bulletin No. 3, describing and illustrating complete Lloyd line of Fluorescent Lamp Holders, Starters, Starter Sockets and Holder and Socket combinations. Lloyd Products Company, Providence, R. I.

117. MECHANICAL CONNECTORS—First Aid for electrical systems through the use of mechanical connectors is the subject of an interesting twenty-page booklet now available. In addition to specific construction and sales of the new "Gorilla Grip," this booklet describes a wide range of mechanical connectors for every size and purpose. National Electric Products Corp., Pittsburgh, Pa.

121. NEW WIRE CATALOG—A new catalog just issued by the United States Rubber Company contains complete specifications for every type of building wire and cable—single conductor and multiple conductor, rubber insulated and synthetic insulated, fibrous covered and lead covered. United States Rubber Co., Rockefeller Center, New York, N. Y.

126. WIRING DEVICES—"Arrow" catalog No. 27 and "H&H" catalog No. "X". 100 pages, lists the complete line of quality, dependable wiring devices, including switches, receptacles, sockets, and plug material. The Arrow-Hart & Hegeman Electric Company, Hartford, Conn.

129. BULLETIN 403 on BullDog enclosed bus bar system of electrical distribution for commercial and industrial use. Forty-four pages of construction details, applications, dimensional data and technical charts. BullDog Electric Products Co., 7610 Jos. Campau, Ave., Detroit, Mich.

130. 1941 FRIGIDAIRE REFRIGERATORS are described in this colorful book. Included are full page, color pictures of various models together with specifications and descriptions of features. Frigidaire Div., General Motors Sales Corp., Dayton, Ohio.

132. INDUSTRIAL WIRING HANDBOOK: This 48-page handbook, called "Adequate Wiring for Industry," describes modern factory wiring methods and materials. Wiring practices adaptable to all factories are outlined. Publ No. 51-4011. General Electric Co., Appliance and Merchandise Dept., Bridgeport, Conn.

141. NEW FLUORESCENT BOOKLET — "How to Speed Sales with G. E. Fluorescent Lighting." This booklet reviews the progress of lighting since the year 1602 up to the present time and is completely illustrated with pictures, charts and recommendations for modern fluorescent illumination. Lamp Department, General Electric Company, Nela Park, Cleveland, Ohio.

142. ELECTRICAL CONDUIT: Complete technical information on corrosion-resisting asbestos-cement ducts for underground and overhead service, with and without concrete envelop, is included in "Transite Conduit and Korduct for the Electrical Industry," DS Series 410. Johns-Manville, 22 East 40th Street, New York, N. Y.

144. UNIVERSAL ELECTRIC RANGES—Complete line folder giving features of models in Universal 1941 line of electric ranges and telling "Precision Cooking" story. Folder No. 6420. Landers, Frary & Clark, New Britain, Conn.

146. ATTIC VENTILATION: New bulletin giving complete information about all-electric, dependable, trouble-free Timers for automatic control of attic fans. Mechanism timed and operated by slow-speed, self-starting synchronous motor. No clock works. Bulletins available on other Timers and Time Switches. Paragon Electric Company, 409 South Dearborn Street, Chicago, Ill.

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148. LITTLE GIANT RELAY—A new small Relay for use on A. C. or D. C. is described in a Ward Leonard Bulletin No. 105. The Relay is available in single pole, single or double throw contacts. On standard frequencies, coils can be obtained for 6 to 230 volts. Complete information on contact rating is given in the bulletin. Ward Leonard Electric Co., Mount Vernon, N. Y.

149. ELECTRIC RANGE UNITS: Chromalox Bulletin CF-107 lists proper assembly and adaptor ring to fit any range, regardless of age or make. Inventory investment and servicing reduced to minimum. Units same as used on many makes of new ranges. Edwin L. Wiegand Company, 7600 Thomas Boulevard, Pittsburgh, Pa.

150. ELECTRIC HEATING UNITS AND EQUIPMENT—Chromalox Catalog 38 contains 64 pages of illustrated descriptions and specifications of standard Chromalox units designed for all industrial applications of electric heat requiring temperatures up to 1000° F.—also valuable information for calculating heat requirements, etc. Edwin L. Wiegand Company, 7600 Thomas Boulevard, Pittsburgh, Pa.

151. ATTIC FAN MANUAL — New four-page bulletin, No. 204-B, entitled "The Coolvent System of Home Ventilation," gives specification data on Coolvent attic fans, suction chambers and automatic louvres. Diagrams in color illustrates attic cooling principle. Text and drawings describe proper installation of the complete System. Autovent Fan & Blower Co., Chicago, Ill.

153. AC WATTHOUR METERS—This new 48-page bulletin features AC watthour meters, including single phase, single disk 2, 2½, and 3 element; meter and time-switch combinations; maximum demand registers; and accessories. Design and construction details are described and illustrated and views of assembled and disassembled component parts are shown. The booklet contains connection diagrams, outline dimensions, and prices. Ask for bulletin No. 97. Sangamo Electric Co., Springfield, Ill.

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